

# “SOUTHERN BELLE”

## A New Locomotive for Gauge “I”

L.B.S.C.R. 4-4-2 “Atlantic” of class H.2

*by Martin Evans*

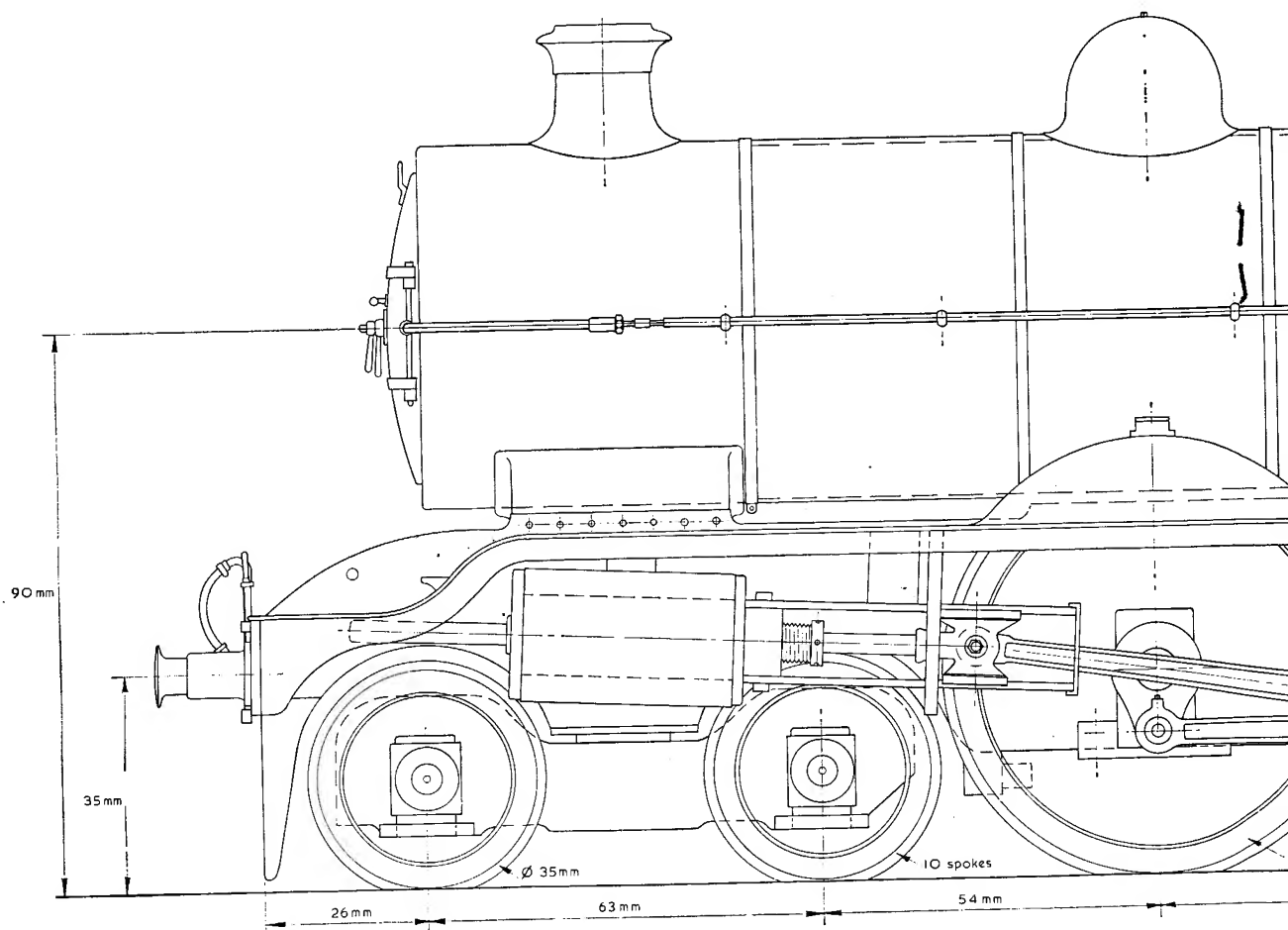
IT IS SOME TIME since a Gauge “I” locomotive was described in *M.E.*, and it is also quite a time since a representative of the Southern Railway graced these pages. In looking round for a suitable prototype, I was impressed by the advantages of the wide firebox on these small gauges, especially if a locomotive type boiler was contemplated. After some correspondence with Tony Hobson of “Loco-steam”, a Southern “Atlantic” was suggested, and this seemed the ideal prototype for a Gauge “I” locomotive, having the wide firebox, outside cylinders and inside valve gear, so that either a full Stephenson gear or slip eccentric gear could be adopted, without spoiling the appearance of the model.

Some notes on the Brighton “Atlantics” may be of interest. The first point about these engines was their similarity to the famous “large” Atlantics of the old Great Northern Railway. But this was to be expected, as Douglas Earle Marsh, the Locomotive, Carriage & Wagon Superintendent at the time, had come from Doncaster, where he had been

Chief Assistant Mechanical Engineer and Manager of Doncaster Works under H. A. Ivatt.

Marsh was the son of a Norfolk clergyman and became a pupil of William Dean at Swindon in 1881, becoming assistant manager in 1889. One of his first acts on taking over at Brighton was to order a batch of “Atlantics” from Kitson & Co., in April 1905, using a set of the Doncaster drawings with a few modifications which were appended in red ink! The modifications were as follows: stroke increased to 26 in., working pressure raised to 200 p.s.i., frames lengthened to the rear of the trailing wheels, deeper Wootton fireboxes, squarer cabs with the roof supported on pillars, Billinton pattern chimney and safety valves, bogie brakes, Westinghouse brake gear and screw reverse instead of lever.

The cylinders had balanced slide valves and the arrangement of the Stephenson gear was similar to the Great Northern engines with the expansion link behind the leading axle and the intermediate valve spindle curved upwards to clear that axle.



Cylinders  $\frac{7}{16}$  bore X 20 mm stroke

GENERAL

After the usual trial period, the H.1s were painted in the new umber livery with gold lining, and at the first repaint, monograms, formed of the Company's initials, were added to all the splashers.

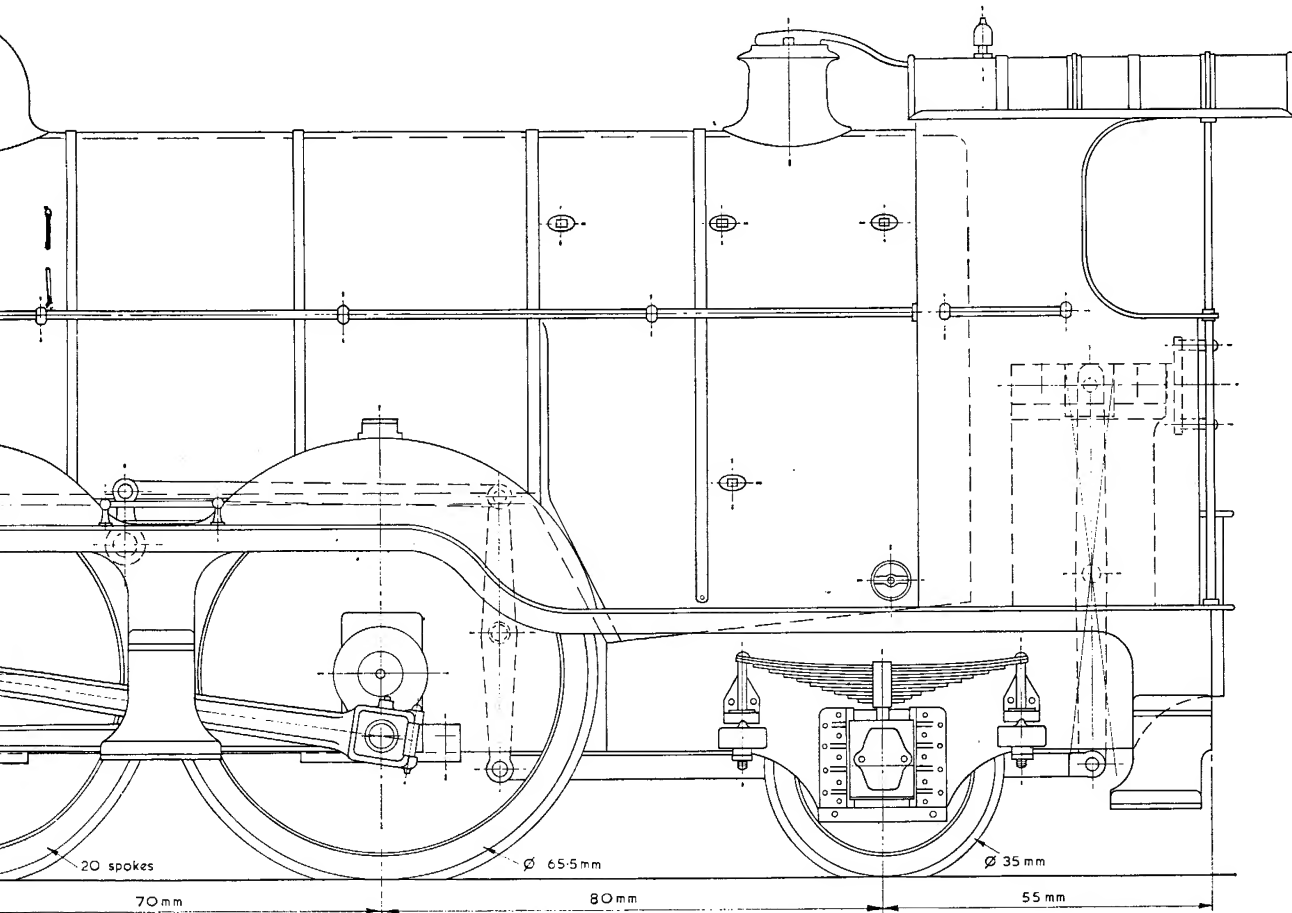
The new "Atlantics" were immediately successful, although Nos. 37 and 38 were for a time plagued by hot trailing axleboxes. They were employed on expresses between Victoria and Brighton, including the well-known "Southern Belle", which included one of the new 12-wheel Pullman cars.

When further express locomotives were required in 1910, the powerful 4-6-2 tank *Abergavenny* was built, but in the absence of Marsh through ill-health, the Locomotive Committee did not follow up the 4-6-2 tank design but ordered a further batch of "Atlantics", the H.2 class.

The H.2 class consisted of six engines, built at Brighton in 1911. Unlike the H.1s, the new locomotives were superheated, using Schmidt type elements, the cylinders were enlarged to 21 in. x

26 in., but the working pressure was reduced to 170 p.s.i. Other modifications included 10 in. piston valves, saddle-supported smokeboxes, flared safety valve covers, Marsh built-up chimneys, carriage heating apparatus and the running boards straightened between cylinders and coupled wheels. The heating surfaces were: large tubes (24 x  $5\frac{1}{4}$  in.) 522 sq. ft., small tubes (171 x 2 in.) 1430 sq. ft., firebox 136 $\frac{1}{2}$  sq. ft., and superheater 337 sq. ft., a total of 2425 $\frac{1}{2}$  sq. ft. Grate area 31 sq. ft.

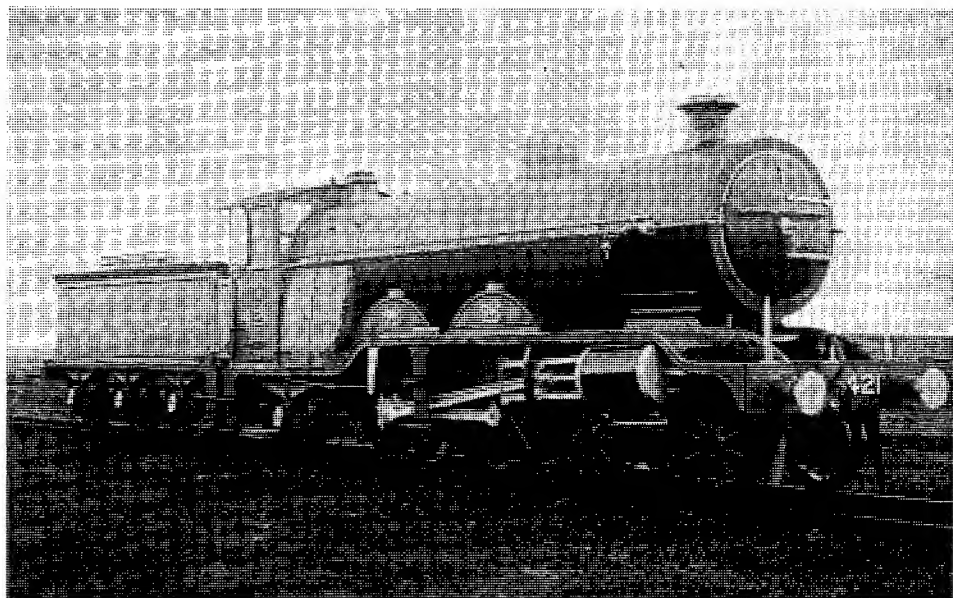
After "grouping", the Brighton "Atlantics" were painted Maunsell dark green as they came into the works for general repairs, and in 1925, the Publicity Department at Waterloo decided that express passenger locomotives should be named. The "Atlantics" were then named as follows: No. 37, *Selsey Bill*; No. 38, *Portland Bill*; No. 39, *Hartland Point*; No. 40, *St. Catherine's Point*; No. 41, *Peveril Point*; No. 421, *South Foreland*; No. 422, *North Foreland*; No. 423, *The Needles*; No. 424,

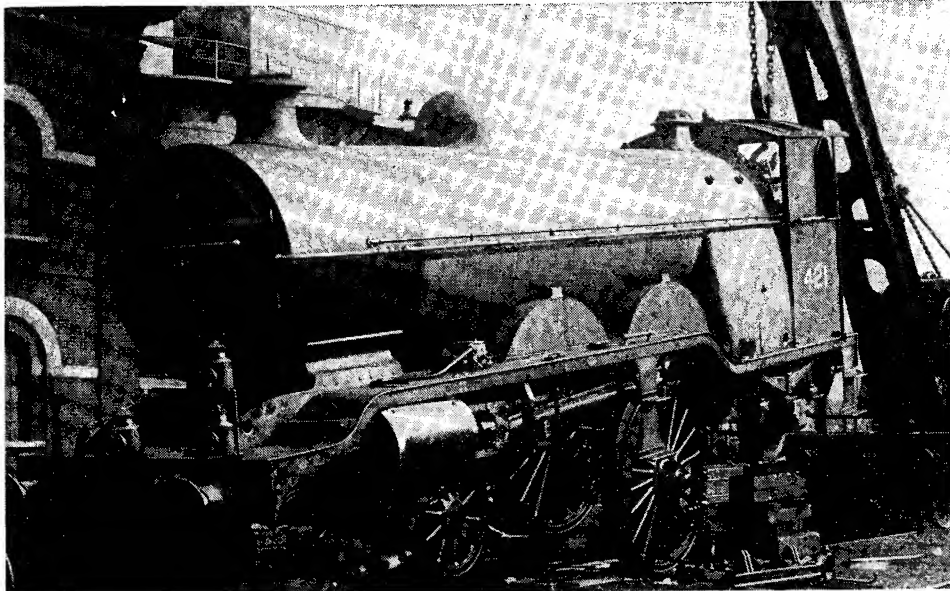


GENERAL ARRANGEMENT 2 X FS

*H.2 class  
"Atlantic"  
No. 421  
in L.B.S.C.R.  
colours.*

*Photographs  
courtesy  
Bert. Perryman.*





"H.2"  
No. 421  
being  
dealt  
with in  
Brighton  
Works  
about  
1911  
for a  
"hot box".  
Photograph:  
Bert.  
Perryman.

Beachy Head; No. 425, Trevoze Head; No. 426, St. Alban's Head.

No. 39 ran as *La France* until renamed in 1926.

In later years, Maunsell fitted his own design of superheaters to all the "Atlantics", and around 1935, the working pressure of the H.2s was increased to 200 p.s.i., bringing them into line with the H.1s which initially were livelier than the 170 p.s.i. engines.

*Hartland Point* was the engine selected by Bulleid to act as a mobile test-bed for the "Leaders", being fitted with sleeve valve cylinders.

The "Atlantics" generally had long lives, No. 424 surviving until 1958, though H.1s Nos. 40 and 41 were withdrawn in 1944.

I am indebted to the Railway Correspondence & Travel Society for the above information.

### The model

My gauge "I" model is of the H.2 class, and will be fitted with a proper locomotive type boiler, though this will be suitable for firing by coal or butane as preferred. Full Stephenson valve gear is provided for, and the external proportions will be almost exactly to scale. One problem I encountered (which applies equally to models of the Great Northern "Atlantics") was the very close spacing of the driving and coupled wheels. Had the wheelbase been made exactly to scale, the flanges would have had to be exactly to scale too, otherwise the wheel flanges would have touched. In fact, even if both were to scale, the clearance would hardly have been sufficient for a working model. I therefore decided on a compromise, by very slightly increasing the wheelbase over the scale figure and allow-

ing the flanges to be slightly shallower than the strict dimension given by the Gauge "I" Association Standards. All other wheel and axle dimensions will however be to the agreed (coarse) Gauge "I" standard.

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### "ELLA" From page 501

the water is blown out by opening the stop cock. Usually a little oil comes out first. A good deal of oily emulsion comes out with the water. If it is necessary to drain the lubricator on a cold engine, the filler has to be removed and replaced several times to pump the water and emulsion out as gravity alone is not enough.

Manufacture is quite straightforward but care should be taken not to leave any flux residues inside. Easyflo is soluble in water but if no flux is applied to the inside of the tube in the first place no trouble can occur.

The drain plug cock is the same size as the injector water cock and it is therefore convenient to make this next.

The injector water cock on Heywood's engines was operated by a lever on the footplate controlled by the driver's boot. I have put the lever in the correct position on the model.

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*The photographs of the Matheran Hill Railway in the "Ella" article, pages 393/4, were reproduced by courtesy of Mr. R. Jones.*

# “SOUTHERN BELLE”

## A New Locomotive for Gauge “I”

L.B.S.C.R. 4-4-2 “Atlantic” of class H.2

Part II

by Martin Evans

From page 496

AS IN MY GAUGE I *Green Arrow*, I have specified 3/32 in. thick bright mild steel for the main frames of *Southern Belle*. The reason is simply that the extra thickness, over the more common 1/16 in., enables us to dispense with hornblocks or horncheeks. The buffer and drag beams are machined from square brass bar, the slots being milled out to receive the frames. Note that the fixing holes for the frames must be drilled in the outer lugs of the buffer and drag beams first, not in the frames themselves as is the more usual practice. When the frames are assembled in their slots, the clearing size drill can be run through the frames just far enough to start the hole in the rear lug of the buffer/drag beam, which can then be drilled tapping size for the 6 BA bolts (No. 43).

Returning to the frames, I have shown seven No. 50 holes above the cylinder cutaway for bolts to hold the smokebox saddle, so that 10 BA hexagon-head bolts or screws can be used to hold this item. As these heads lie just above footplate level, they will be rather prominent, so that anything larger than 10 BA would not look very nice. On the other hand, the holes to take the bolts for the bogie pin stretcher are just below the cylinders, so that 8 BA bolts can be used here without offending exhibition judges or L.B.S.C.R. enthusiasts.

It will be noticed that the rectangular cutaway for the cylinders is not equally disposed about the inclined cylinder centre line. This I found to be unavoidable, although it proved a perfect nuisance when I was trying to draw up the cylinders. The reason is the “out-of-scale” curved bogie wheel clearances, for it can be seen from the frame drawing that there is none too much metal left between the bottom rear corner of the cutaway and the bogie wheel “arch” even now. Incidentally, I have not given the exact angle of inclination of the cylinders, as the easiest way to mark this out is by a dimension taken from the front bottom corner of the buffer beam (14½ mm.). So scribe a line from this point to the centre of the driving axle (which is 12½ mm. from the bottom of the frames) before cutting the axlebox slots.

The three 8 BA countersunk screws arranged vertically ahead of the leading coupled axle are to

hold a frame stretcher which also supports the axle-driven pump, the barrel of which is arranged on an angle so as to clear the leading axle.

The two 8 BA tapped holes near the top edge of the frames above the leading coupled axle are for the expansion link suspension lever and the intermediate valve rod suspension lever respectively. The 5/32 in. hole a little further to the rear is of course for the weighshaft, as the reach rod (or rather intermediate reach rod) can be seen in my frame drawing. This intermediate reach rod is connected to a long lever pivoted approximately at its mid point, so a comparatively large pivot pin is required here, just ahead of the trailing frame, which is screwed into the 4 BA tapped hole in the main frame.

The trailing frames are bent up from the same material as the main frames in one piece. If the steel is heated, bending should not be difficult, but if any builder prefers to make the trailing frames in three pieces, angled in the corners, this would be just as satisfactory.

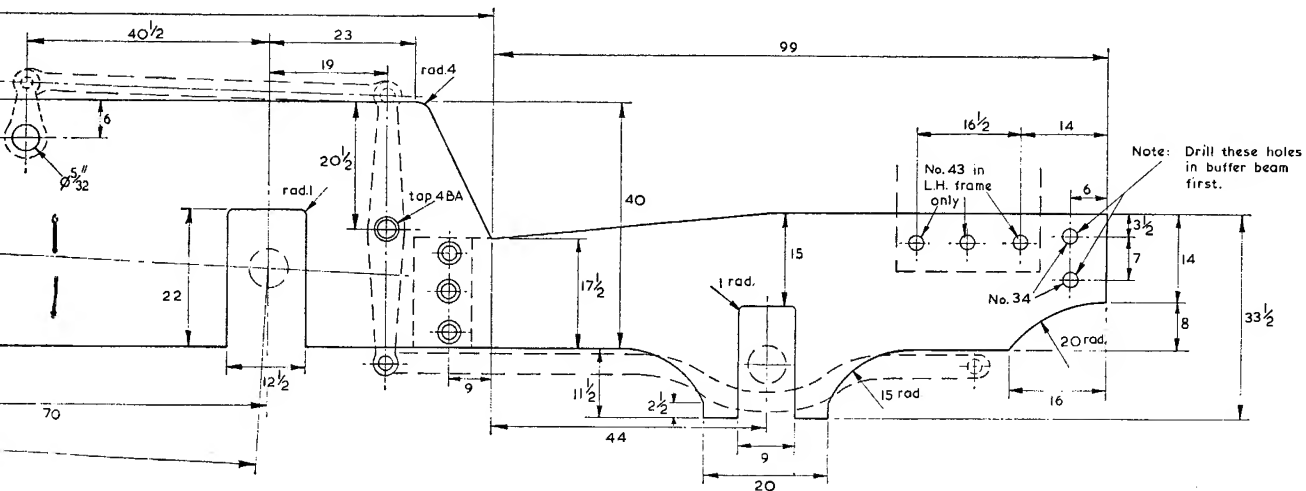
The one-piece trailing frame is held to the main frames by ½ x ½ x ⅛ in. angles, riveted to the trailing frame with 6 BA countersunk screws put through the main frames into tapped holes in the angles.

Before leaving the subject of the frames, it will be noticed that at the extreme front end they are “thinned out”. This can be done by filing, it is really only a gradual chamfer, so that the frames will appear to be of approximately half their actual thickness. This is done between the buffer beam and the smokebox saddle, where the frames would look terribly heavy if left the full 3/32 in. thickness on the top edge.

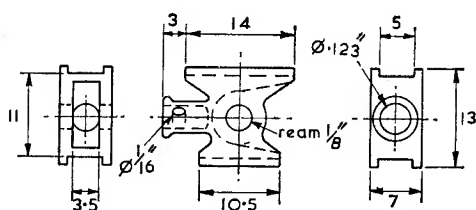
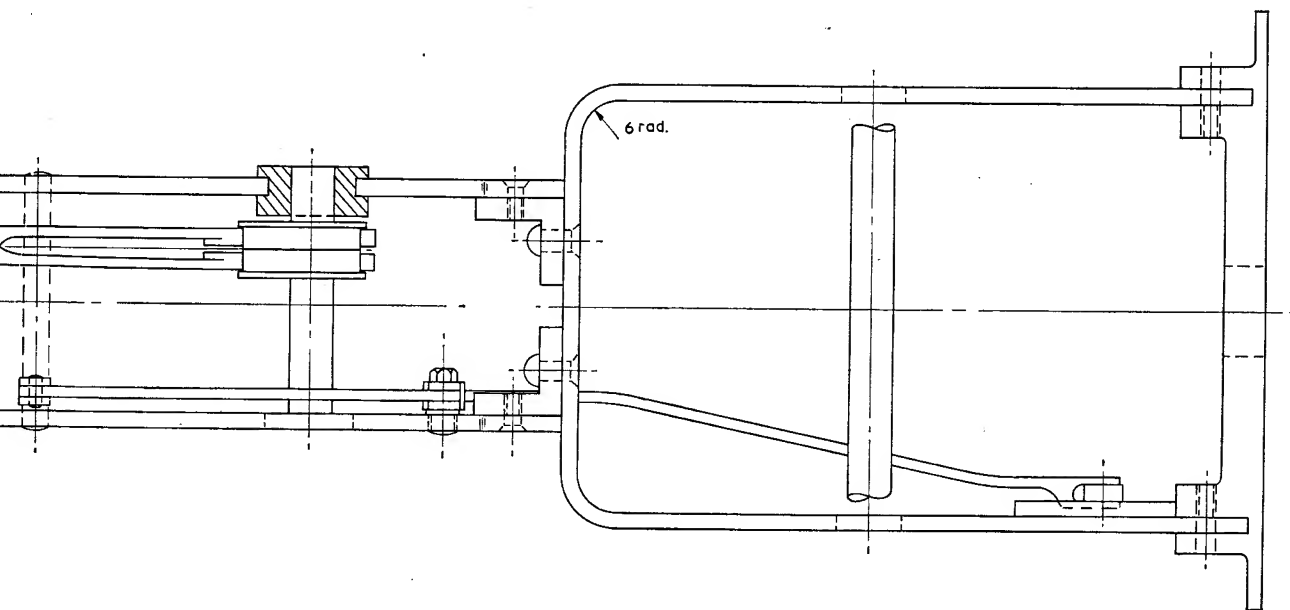
The driving and coupled wheels can be made a press fit on their axles, or a “Loctite” fit can be utilised. I must admit that I have not used Loctite for securing Gauge I wheels on their axles, but I see no reason why it should not be equally successful as on the bigger gauges. It has the great advantage that “quartering” can be carried out in a leisurely manner, while the Loctite starts to “act”.

There have been literally dozens of methods described for “quartering” driving and coupled wheels in *M.E.* over the years, and after trying

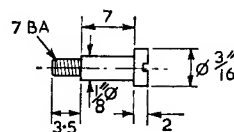




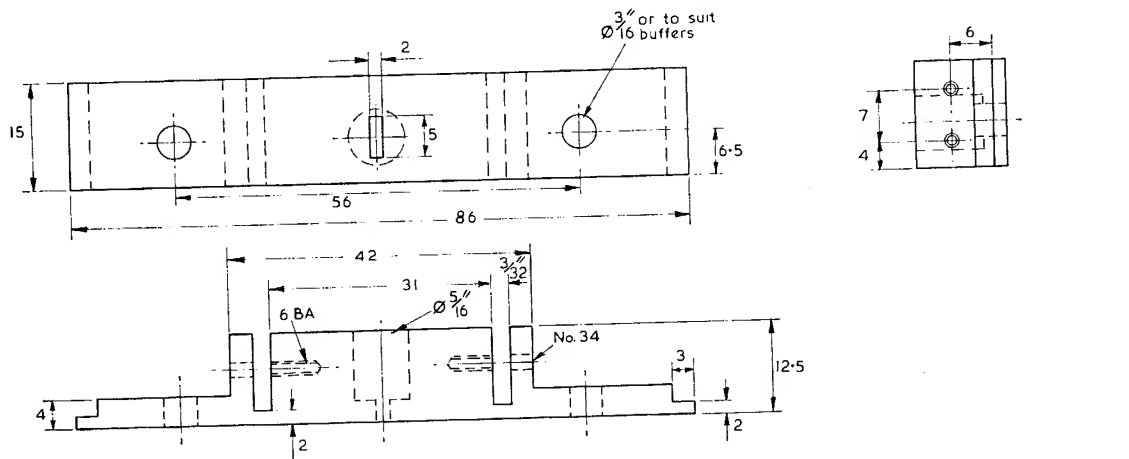
**Note:** The distance from driving axle centre to bottom of frames should be 12½ mms.



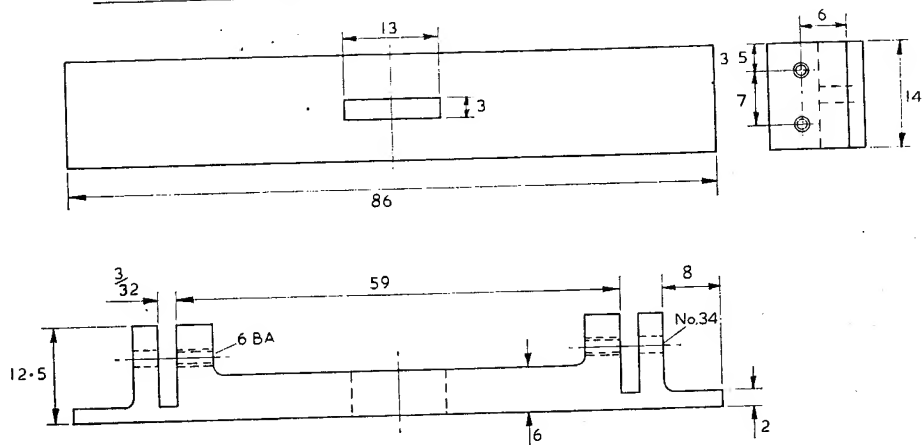
CROSSHEAD: b.m.s. case-harden



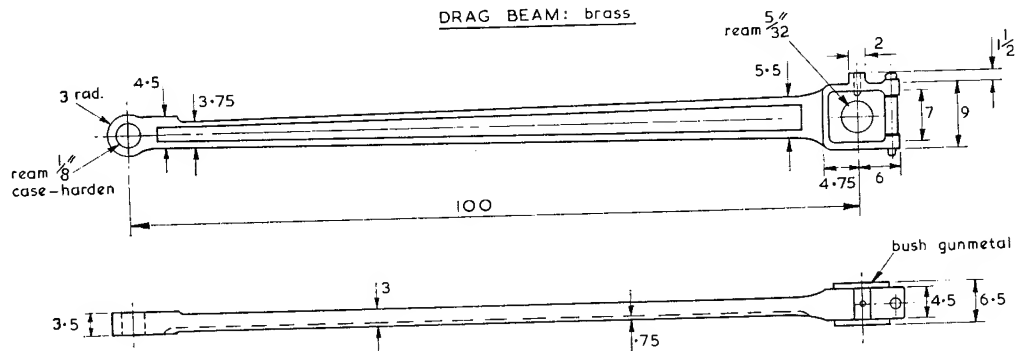
GUDGEON PIN: silver-steel or b.m.s. case-harden



BUFFER BEAM: brass

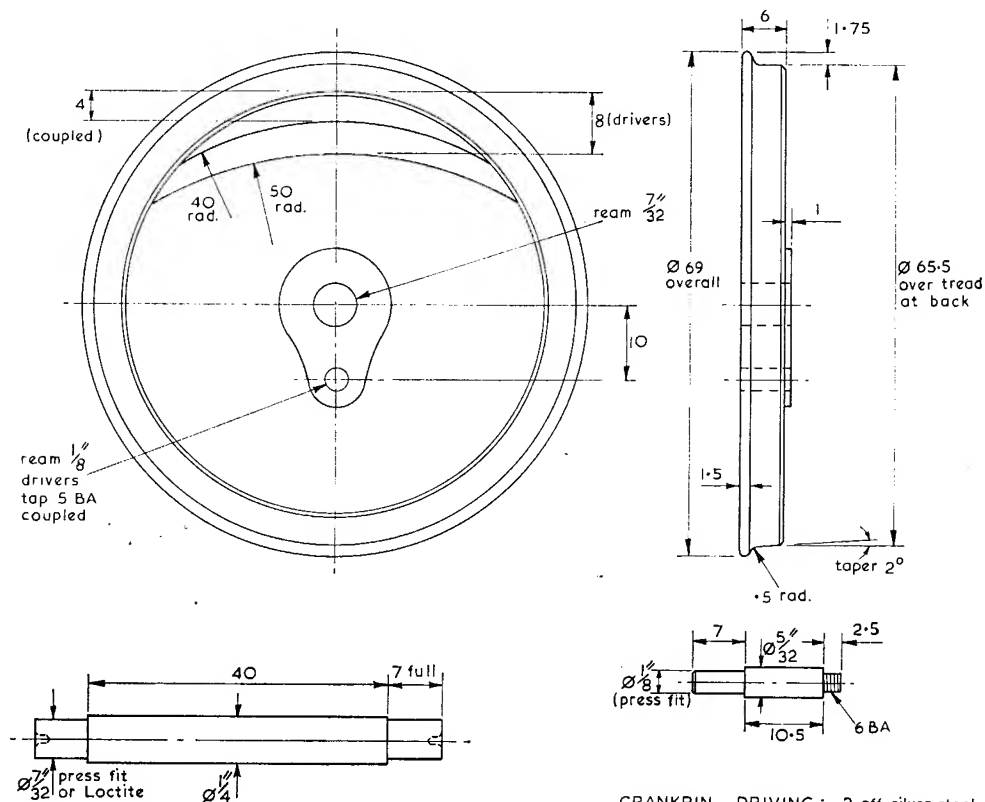


DRAG BEAM: brass

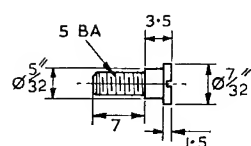


CONNECTING ROD: L.H. drawn b.m.s.

ALL DIMENSIONS IN MMS  
EXCEPT WHERE OTHERWISE  
STATED.



DRIVING & COUPLED AXLE : ground m.s.



CRANKPIN - COUPLED: 2 off silver-steel

Allen cap screws being used to hold the plates and stretchers firmly together. But before assembling the plates, one is marked out and the two clamped together for drilling and reaming. A central reamed hole is required and two other holes, one vertical and the other at 90 deg. to the first, these being at a distance from the centre hole equal to the stroke of the engine.

Turned pins, a good fit in the central holes in the jig, with the ends turned to a point, to match the centres in the axles, are now inserted in the central holes on each side of the jig, and the crank-

pins (which are of course previously fitted to the wheels) are entered into the appropriate holes in the jig, the two plates of which are now bolted up. When all is well at this "trial assembly" one plate only of the jig is removed, the wheels and axle removed and the wheel seat of the axle given a light film of Loctite 35 ("high-strength"), the wheels replaced, turned a few times on their axles, to ensure that the adhesive is evenly spread, and the pair on axle replaced in the jig, the loose plate being replaced and bolted up. The set-up can be left overnight with advantage, before removing from the jig and the insertion of the second pair. One important point in the use of Loctite is to ensure that both the axle and bore of the wheel are really clean before starting work.

## FULL-SIZE DRAWINGS OF SOUTHERN BELLE

*LO.948 Sheet 1. General Arrangement, main and trailing frames and plan of frames. Price 85p*

# "SOUTHERN BELLE"

## A New Locomotive for Gauge "I"

L.B.S.C.R. 4-4-2 "Atlantic" of class H.2

Part III

by Martin Evans

From page 601

THE CYLINDERS for *Southern Belle* are fairly straightforward and bear a strong resemblance to those of *Rob Roy* though of course only half the size. Taking the blocks first, these can be held comfortably in the 4-jaw chuck. Gunmetal castings will be available shortly, and as is usual with all castings, an old file should be used to clean up the outer surfaces to remove sand and scale.

The next problem is then, which side to machine first? I prefer to machine the port face first in this instance, and check that the bores are machined square to this. Beginners should not forget to use a piece of some soft metal such as brass or aluminium between the chuck jaws and the machined surfaces, as these are dealt with.

After finishing the port face, turn the block through 90 deg. and face one end, leaving enough metal to clean up the other end later. To make sure that the bore comes out right, it pays to plug the rough bore with a piece of hardwood, and mark the true bore centre on this. Get this running true, then knock out the plug and bore with a good stiff boring tool in the toolpost, using as little overhang consistent with the need for the tool to pass right through the bore. Owners of small lathes will have to check that there is clearance for their boring tool to pass through without fouling the lathe spindle, but this should not worry those with ML.7s or ML.10s.

Whether steam engine bores should be reamed is

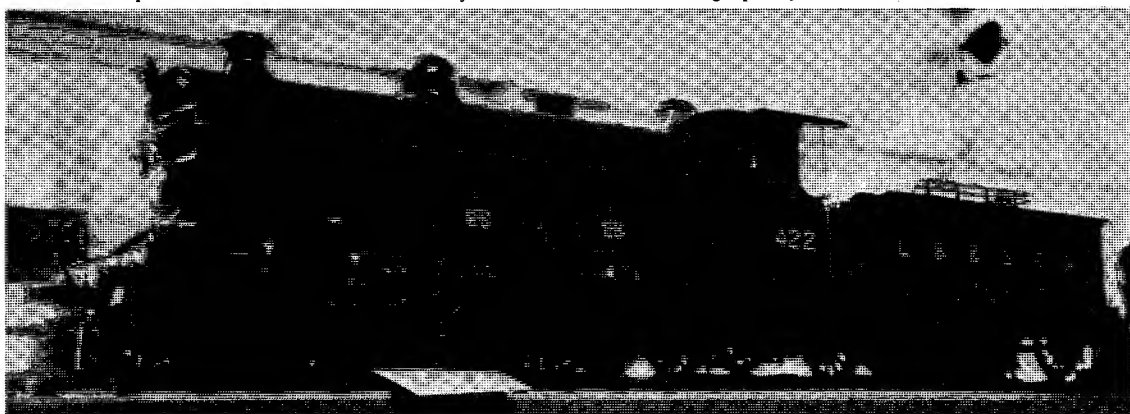
often the subject of hot debates. I never use reamers on the larger cylinders, but there is a reasonable argument for using a 7/16 in. one, which is the finished size of *Southern Belle's* bores, especially if the lathe is of 3½ in. centre height or bigger. If reaming, end the boring operation at about 3 thou. undersize, and put the boring tool right through at least twice without altering the final cut.

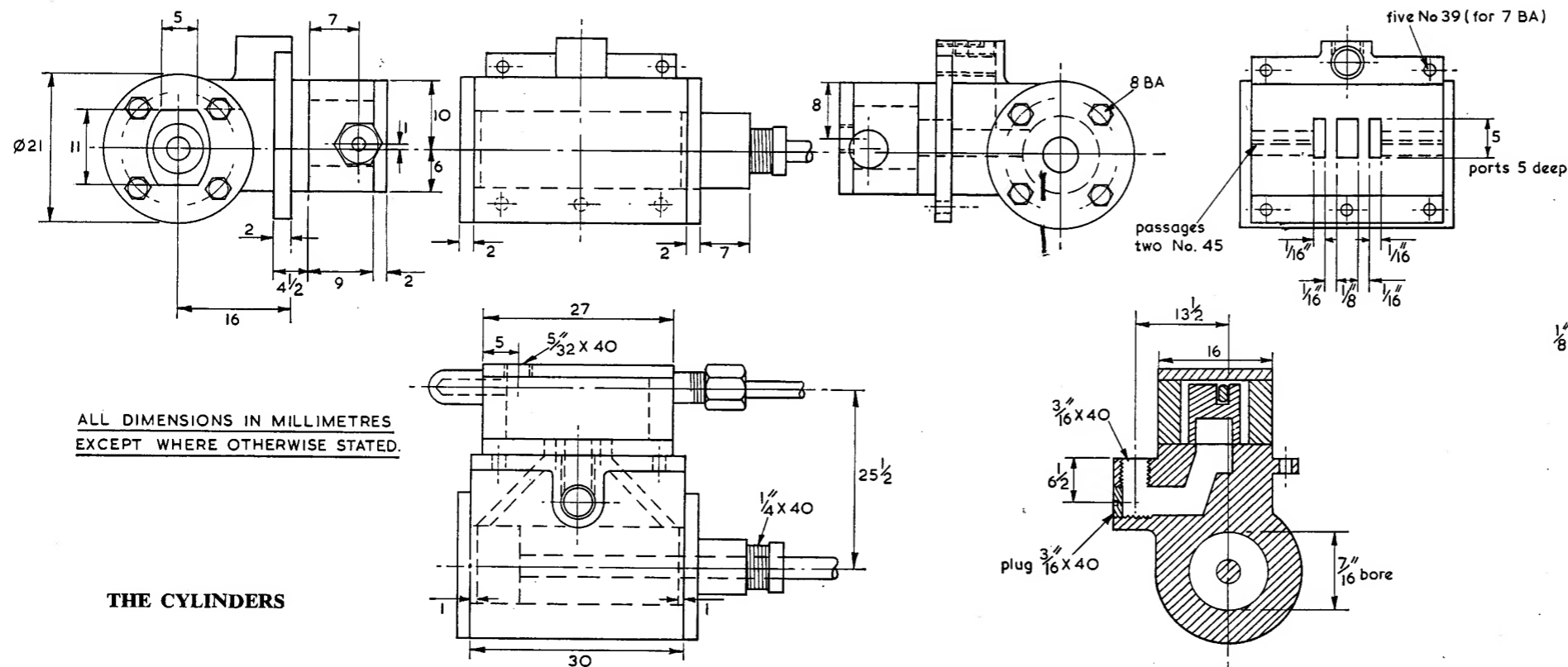
To machine the other end of the block, the usual practice is to turn up a brass "mandrel" of such a size that the cylinder can just be pushed on by hand. If the facing cuts are light ones, it won't shift; in fact it is more likely to be a bit difficult to get off the mandrel again!

The boss on the top of the cylinder block casting can be machined, and by careful adjustment of the chuck jaws, it will be possible to drill and tap the hole for the exhaust pipe (which has to be plugged later on). The remaining surfaces of the cylinder, being non-working faces, can be filed.

It will be noticed that the cylinder block is longer than the length of the rectangular slot in the frames. As mentioned before, I found it impossible to make the frame slot the full length without seriously weakening the frame, but as the part of the cylinder block which passes through the frame has to be machined all round, this should not present any extra difficulty, in fact it can be done at the same set-up as we require to end mill the ports.

*A fine 5 in. gauge L.B.S.C.R. "H.2 Atlantic" built by R. E. Hines. It gained second place in the Locomotive Section Competition at Harrow and Wembley Exhibition 1971. Photograph by Ron Isted.*





The vertical-slide is set up facing the lathe headstock and a small angle plate bolted to this and set truly horizontal. The cylinder is then bolted down on the angle plate by a bolt (plus a soft metal washer) through the bore. The end mill can then be worked all around the port face to reduce it to the exact size of the frame slot.

The ports can all be milled using a 1/16 in. dia. end mill or slot drill. I think this is the smallest size available commercially, and although it may cut a shade oversize, this can be minimised greatly by holding the end mill with the minimum of overhang, by using a high speed and by very light cuts. The end mill will of course leave rounded corners to the ports, but this is of little consequence. Mill the ports 5 mm. deep, then drill the steam passages (two No. 45 holes) and the exhaust passage, being careful that the drill for the latter does not catch the edges of the exhaust port.

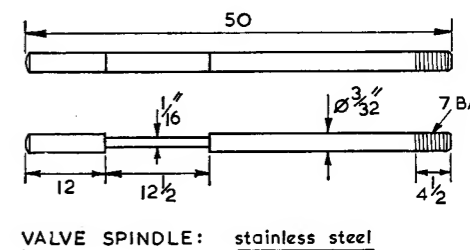
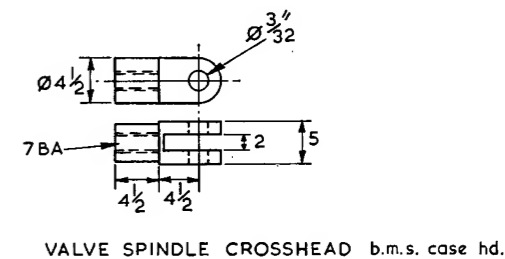
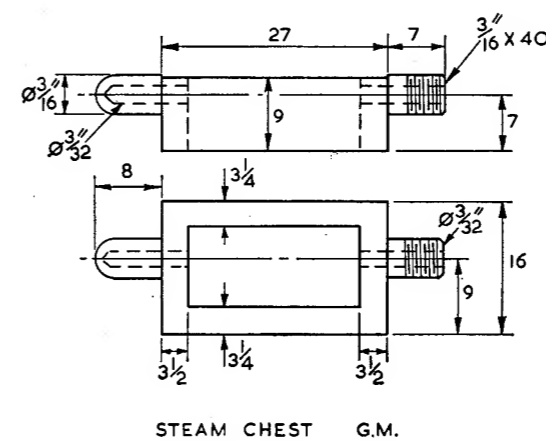
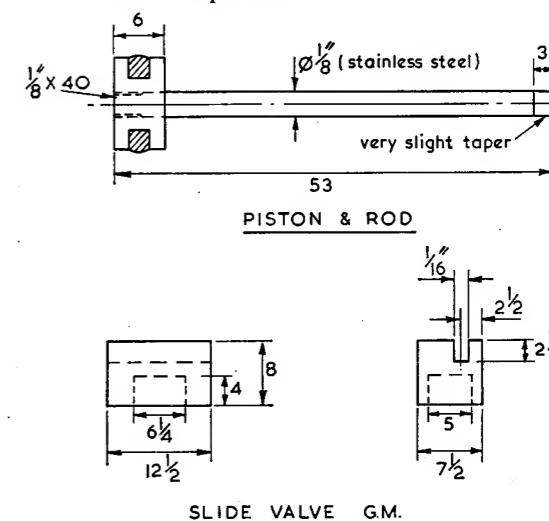
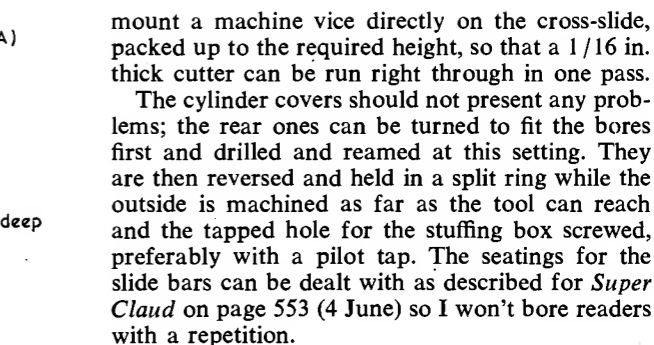
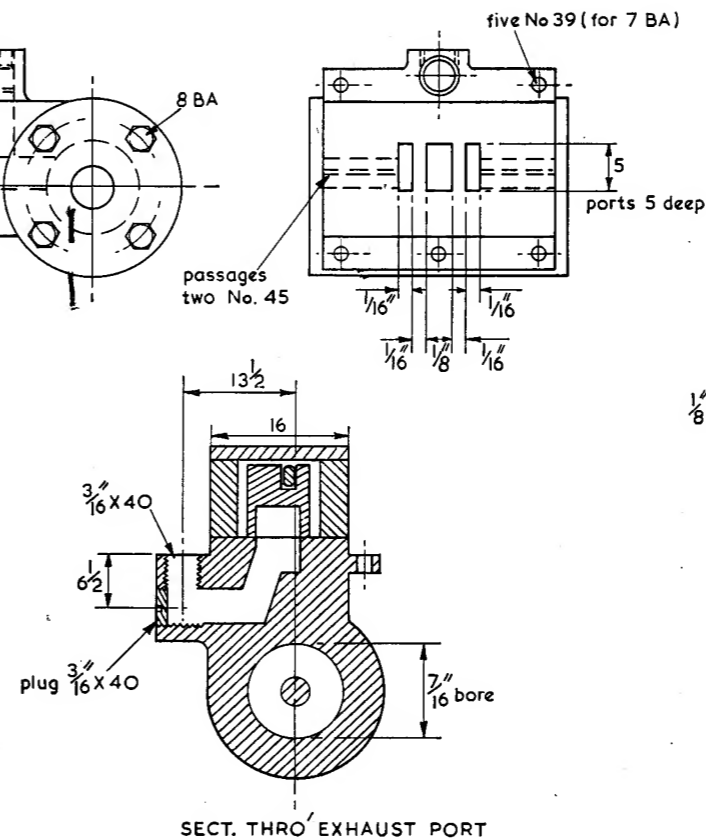
The cylinder block is held to the frames by five 7 BA bolts, though even 8 BA would be strong enough as all the thrust from the piston is taken directly by the frame in this design.

Little need be said about the steam chest, except that its dimensions should be adhered to as closely

as possible, as it will be noted that the front and rear valve spindle bosses lie very close to the top edge, in fact they overlap the steam chest before the cover is put on. Castings will almost certainly have the bosses cast on, in which case the front boss could be turned first, the steam chest being held in the 4-jaw with a plate top and bottom to enable the chuck jaws to clear the bosses. The chest could then be reversed and held in the 3-jaw or in a collet by the turned boss, while the other end is machined, taking very light cuts. The rear boss can at the same time be threaded 3/16 in. x 40 t. and drilled and reamed right through 3/32 in. dia.

The top of the steam chest cannot be turned in the usual way, as the bosses will get in the way of the turning tool, but it could be end milled, face milled, or even filed, without any great difficulty. The top cover is just a slab of 2 mm. thick brass sheet, and it is drilled and tapped 5/32 in. x 40 t. for the steam entry.

Drawn gunmetal can be used for the slide valves, the outside faces being machined using the 4-jaw, and the cavity end milled, using the 1/16 in. dia. end mill again. The driving slot is best cut with a slitting saw, and one way to hold it would be to



Drawn gunmetal is again used for the piston. Some use aluminium alloy, but I don't like this for pistons owing to its greater expansion factor. The rod is stainless steel, and the piston is fitted by the commonly used method of "half-press fit and half thread". A very slight taper is put on the other end of the piston rod, using a dead smooth file. This should be just enough to enable the rod to be pushed home into the crosshead (see page 599, 18 June) when it can be pinned at a later stage.

Some builders may prefer a screwed crosshead, in which case 5 BA can be used.

The valve spindle is made from 3/32 in. dia. stainless steel. Flats are filed or milled to fit the valve closely. This will have to be done very care-

fully, so that there is no shake, yet the valve must be quite free to lift slightly off the port face. This method of driving the valve means that the finest adjustment that can be made when valve setting is half a turn of the valve crosshead, which in the case of a 7 BA thread is about 1/96 in. If anyone has taps and dies for 3/32 in. x 60 t., these could be used, which would give a rather finer adjustment.

Before starting on the valve gear, the valve spindle crossheads could be made, and here we can use 1/4 in. square mild or silver steel, the bar being first reduced to 5 mm. x 5 mm., cross-drilled, slotted 2 mm., finally machined in the 4-jaw chuck.

*To be continued*

## **"ELLA"**

*From page 739*

make a circuit of the track will require a given quantity of steam which is very roughly speaking independent of the time taken. The amount of steam you can generate during a circuit on the other hand is a function of the time taken.

Probably the best way to drive is to try to maintain a constant boiler pressure and water level which means nearly a constant steaming rate. This may mean for example that with boiler pressure of 90 the maximum steam chest pressure up the banks may be no more than 35 and less than 20 on the down grades. Driven like this it is possible to take a load of 5 plus driver round the Bristol track and finish blowing off. However, jump on behind and come for an imaginary ride. I will not promise that everything will be done as it should be.

The engine has just done a circuit and the fire bars are being raked out and ash shovelled out of the ashpan; pressure is rising and the injector is put on until the level is nearly up to the top nut and coal is added. The water tanks are filled up. She's blowing off now and the fire has burnt through and should be good when we get to the bank, so we put her in full gear and open the regulator a little and . . . nothing happens. We open the draincocks and we go off gently. Close cocks, a little more steam and pull back to 50% cut off, ease the throttle a bit—we don't want too much pull on a fire made up rather high. Then we are on the bank and coming to the curve and as the speed drops we give her more regulator and 60% cut off. She is going well over the top of the bank, we wonder why, this is the time to ease up and recover some of the pressure we have lost but the blood has gone to our heads and we rush down the bank and rattle over the bridge; it's fun while it lasts. Now we are round the bend and meet the half gale which blew us up the bank. We have a long straight fairly easy climb where we ought to put on a bit of coal and put in a drop of water before the awkward bank and bend by the station

but the priority is to recover the pressure we lost rattling over the bridge. Driving slowly, we make steam up the straight slope but the water level is getting low; when we get to the bend we need more regulator and the pressure starts to drop and over the top we are at full regulator and 70% cut off and hoping! We have made it and are on the run down to the steaming bay where we started—something must be done about that water level and quick. Is there enough pressure for the injector? Better use the hand pump; anyway it won't knock what's left of the pressure back. A quick pump, a couple of shovels of coal, close the blast nozzle a little and another pump and we are back where we started. I did mean to drive more sensibly but I am sorry I had to use the handpump but it was rather fun rattling over the bridge and exciting wondering if we would make it round the bend by the station.

So much for our imaginary drive and I must say something about the use of the controllable blast nozzle—somewhat reluctantly as I have as yet not really mastered the art. The principle is easy enough, one opens the nozzle at high speeds and steam chest pressures and closes it at low powers, but how does one know when the setting is right? If the nozzle is closed to the point where a loss of power is felt, this is certainly too much. If there is a shower of sparks from the funnel this again is far too much. I do not find the sound of the exhaust an adequate guide. After a bit one learns by examination of the amount of ash deposited between the tube plate and the firebox bridge after a run whether or not the blast has been too fierce, but only a few seconds with the wheels slipping can lift the fire and upset one's assessment. It may also be that the fire has been built up too high and has been pushed over the bridge with the shovel.

One thing about writing these notes is that it gives one a fresh angle on the problems and in this instance it makes me think that perhaps it will help me to put some graduations on the reverser stand to show the position of the nozzle control lever.

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## A New Locomotive for Gauge "I"

L.B.S.C.R. 4-4-2 "Atlantic" of class H.2

Part IV

by Martin Evans

From page 756

THE VALVE GEAR for *Southern Belle* is a fairly close copy of that on the full-size L.B.S.C.R. "Atlantics", having the "locomotive type" expansion link and a long valve rod slotted to take the usual suspension lever and with an upwards "set" to allow clearance for the leading coupled axle.

From a purely mechanical point of view, I would have preferred to use the "launch-type" expansion link, as in *Rob Roy* and *Super-Claud*, as it is difficult with the locomotive-type link to keep the eccentric diameter within reasonable bounds.

Looking at the general arrangement of the gear, the forked ends of the eccentric rods seem rather large in relation to that of the valve rod, but the difference is not as great as it appears, and if any builder finds that he cannot quite get the desired full gear valve travel, the eccentric rod forks could easily be reduced to the same radius as that on the radius rod. In any case, I would strongly advise builders not to case-harden any of the parts of the valve gear until the whole gear has been assembled (using temporary pins) and clearances etc. checked. I mention this now because in gauge "I" work, clearances are very fine, and it is not always easy to get components exact to a drawing, while still maintaining sufficient strength.

Perhaps the eccentrics should be made first, so that the driving wheels and axleboxes can be assembled for keeps. Over the flanges, these are 19 mm. dia., so anyone using up his "Imperial" mild steel could use  $\frac{3}{4}$  in. stock, as  $\frac{3}{4}$  in. is just a few thou. over 19 mm.

Members of the Gauge "I" Association will recall a very neat jig for machining eccentrics described in their Newsletter, so I would suggest to them that they look up the article before starting work.

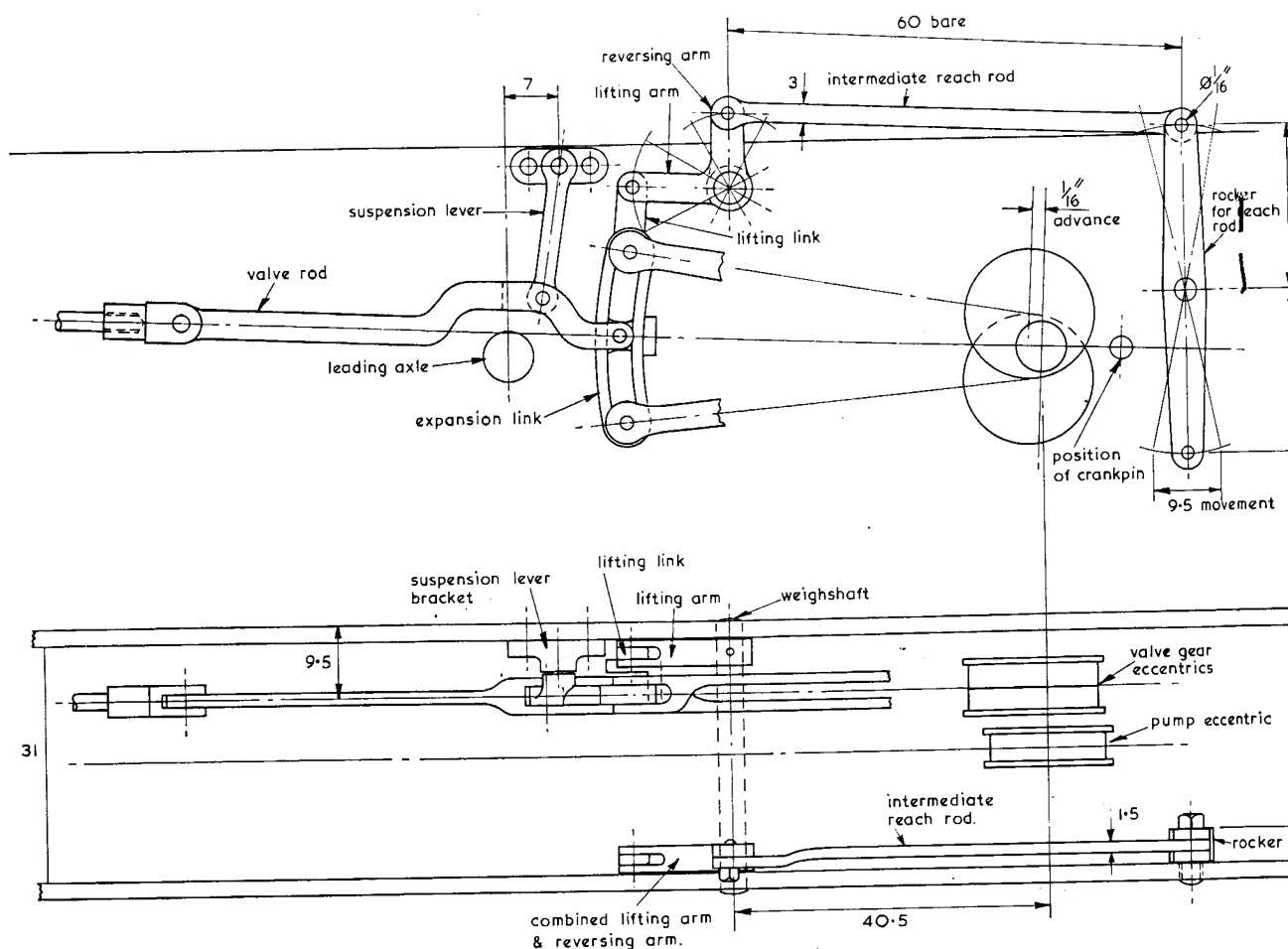
The basis of the eccentric jig, which is the work of Mr. Austin K. Clarke, consists of two steel bars, about  $\frac{3}{4}$  in. x  $\frac{3}{16}$  in. in our case, bolted to the faceplate, parallel to one another and 1 in. apart. Between these bars, a piece of steel bar 1 in. x  $\frac{5}{16}$  in. is allowed to slide. In the top end of this bar, a  $\frac{1}{4}$  in. dia. hole is drilled, to take a  $\frac{1}{4}$  in. bolt through it, with the head on the back of the faceplate. At the other end of this bar, a hole is drilled and bored an exact fit for the eccentrics, in our

case 17 mm. dia. The end of the bar is then split, using a fine saw or a thin slitting saw in the lathe, the slit going into the hole for the eccentric. A pinch bolt is fitted across the bottom of the bar (through the  $\frac{5}{16}$  in. thickness) so that when an eccentric is inserted, it can be held firmly.

A "datum roller" is now made. This could consist of a  $\frac{5}{16}$  in. length of 1 in. dia. silver or mild steel, bored  $\frac{1}{4}$  in. dia., and this is held by a  $\frac{1}{4}$  in. bolt to the faceplate just below the bar holding the eccentrics, using one of the faceplate slots. In between the bottom of the eccentric-holding bar and this roller, a piece of square steel bar about  $\frac{3}{8}$  in. is inserted. The eccentric is now accurately centred, using any well-tried method; it is then bolted firmly to the faceplate and the  $\frac{3}{8}$  in. bar and the roller pushed up tight against it and the roller also bolted firmly.

All we need now is a bar to replace the  $\frac{3}{8}$  in. square bar, that is  $\frac{3}{8}$  in. plus the throw of the eccentrics, which in this case is 4.5 mm. The bolt holding the eccentric-holding bar is slackened, and the bar moved up until the new setting bar can be inserted between the eccentric-bar and the datum roller. On clamping the lot together again, we are now ready for the insertion of the first eccentric, for drilling and boring.

The expansion link is made from  $\frac{3}{32}$  in. gauge plate. I have introduced Imperial dimensions here as I am not sure at the time of writing whether gauge plate in the required metric thickness is available, whereas  $\frac{3}{32}$  in. can be obtained from Reeves or Whistons. The slot in the links should be made first, and the method described for *Super-Claud* (page 815) can be used. I will be pleased to describe the method in full if any builder wishes. The die-blocks are so short that there is no need to mill them. They can be hand filed in a very short time. The link brackets will have to be silver-soldered to the links, but to make the job easier, one small screw (about 12 BA) can be put through the bracket, into a tapped hole in the body of the link, to hold the two together in correct alignment while the silver soldering is carried out. It will not be possible to harden the links right out, but if they are plunged into thin oil as soon as the "redness" dies away, they will be sufficiently hard for our purpose. The pins for the lifting links are

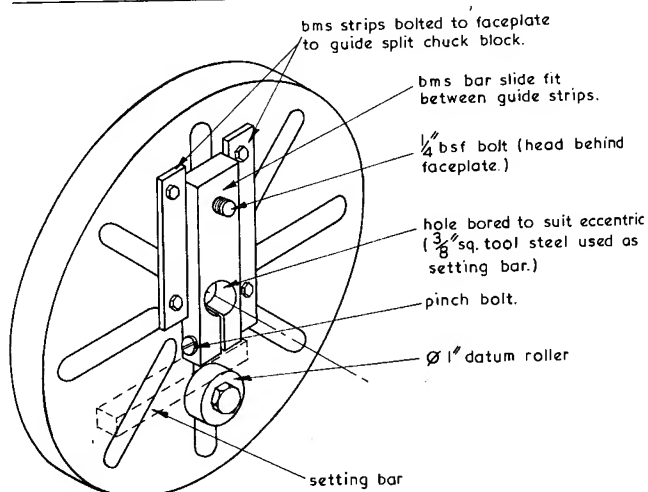


pressed into the link brackets *after* the silver soldering has been completed, otherwise they may work loose with the sudden heating and cooling. As no other fixing can be provided in the available space, it is most important that they don't work loose in service.

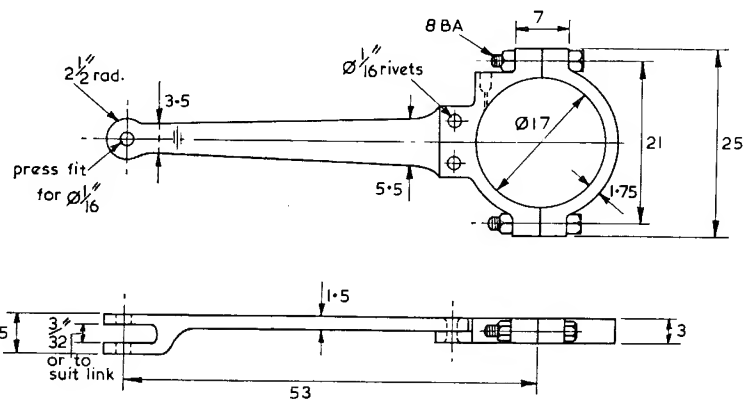
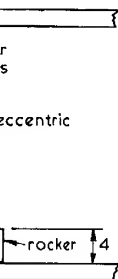
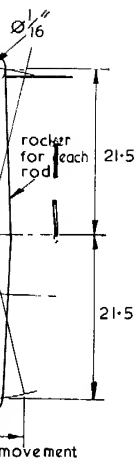
Some difficulty might be experienced in making the valve rods. The important thing to remember is not to try to bend these after drilling and slotting for the expansion link; this will almost certainly lead to trouble. The way I would go about it would be to first file or mill down sufficient square mild steel bar to 5 mm. square section. Then put all the bends in. This should be possible without having to heat the metal at all.

Having achieved reasonable bends, mark out for the three holes and drill them a shade undersize. Next mill out the 3/32 in. slot, using a face cutter if possible. Radius the end of this slot as shown. Then thin down the front end of the rod to a uniform thickness of 2 mm. Finally radius both ends and drill the holes to size, remembering that

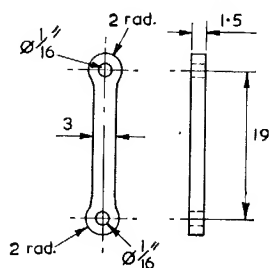
#### LAYOUT OF VALVE GEAR



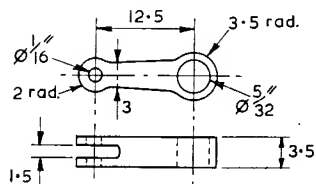
ECCENTRIC MACHINING FIXTURE



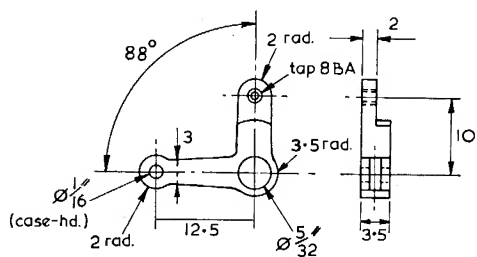
ECCENTRIC ROD & STRAP: rod b.m.s.  
strap g.m.



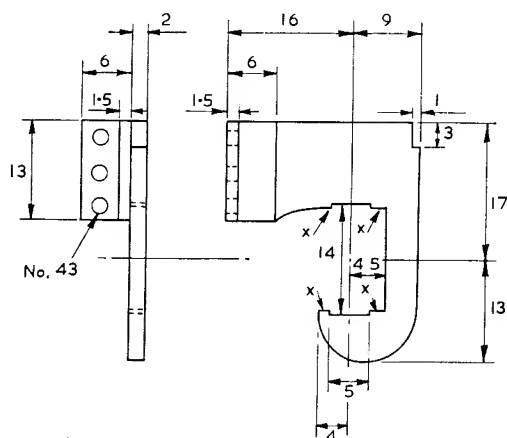
LIFTING LINK: 2 off b.m.s. case-hd.



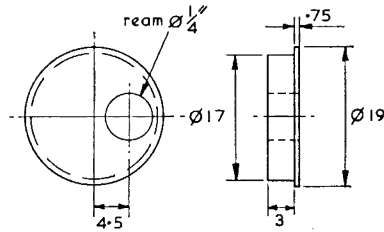
LIFTING ARM — RHS only case-hd. small end only



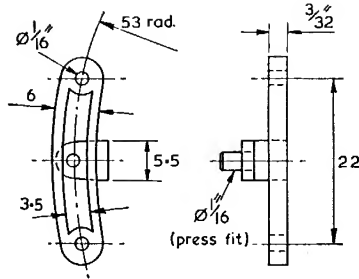
COMBINED LIFTING ARM & REVERSING ARM  
LHS only



MOTION PLATE: b.m.s. (L.H. drawn)  
x to clear crosshead

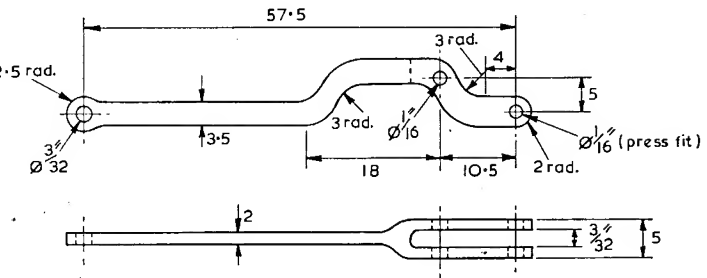
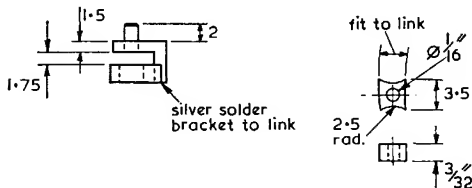


VALVE GEAR ECCENTRIC: 4 off silver steel or b.m.s.

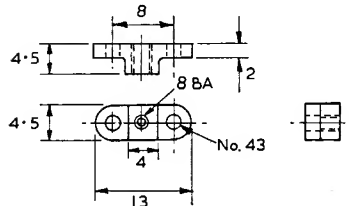


EXPANSION LINK & DIE-BLOCK:

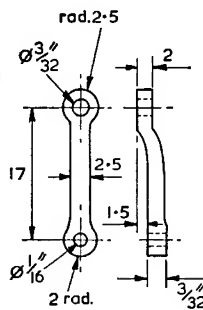
2 off gauge plate



VALVE ROD: 2 off b.m.s. case-hd.

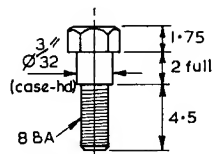


SUSPENSION LEVER BRACKET: 2 off b.m.s.



SUSPENSION LEVER:

2 off case-hd b.m.s.



PIN for SUSPENSION  
LEVER BRACKET:  
2 off steel

the hole at the front end is  $\frac{3}{32}$  in. dia., and that for the die-block is a press fit size for a  $\frac{1}{16}$  in. dia. pin.

Returning now to the eccentrics, the eccentric rods can be cut from  $\frac{3}{8}$  in. x  $\frac{1}{4}$  in. b.m.s., if no close metric size is available. File or mill this down to 5 mm., drill the holes and slot  $\frac{3}{32}$  in. as before, for the expansion link, then shape the outsides. The eccentric rods are riveted to the straps with two  $\frac{1}{16}$  in. iron rivets (though copper would be strong enough here if preferred) countersunk lightly on both sides.

The eccentric straps can be made from gunmetal castings, or cut from bronze bar. If castings, after the usual cleaning up with files, drill the lugs right through No. 50, saw the casting in half, using a fine hacksaw, or better still, a jeweller's coping saw as this removes much less metal, clean up the faces left by the saw, then tap the lugs in the front half 8 BA. Screw the two halves together and chuck in the four-jaw with the hole running as truly as possible. Face the side of the strap and

bore out to a nice working fit on the eccentrics. These being single flanged, means that they can be "offered up" to the strap while still in the chuck. To face the other side of the strap, the four-jaw can be used again, or better still, a short "mandrel" can be turned in the lathe, from a piece of mild steel, to the same diameter as the eccentrics, and the strap held on this by screws through the jugs; a piece of thin paper between strap and mandrel will prevent the strap from slipping.

A simple jig should be made up to ensure that all the eccentrics are exactly the same length—very important with Stephenson valve gear. A suitable jig has been described many times in *M.E.* recently, but if any builder would like details, I will be happy to oblige.

The remaining parts of the valve gear should not present any difficulties. The suspension lever brackets can be quickly cut from 3/16 in. square b.m.s., or the nearest metric equivalent. The right-hand lifting arm is a simple item, but the left-hand one is rather unusual, as owing to limited space, I had to combine this with the reversing arm, to which is attached the intermediate reach rod. It is slightly more difficult to make, but the lifting arm part of it is of course identical to the right-hand arm.

The motion plates are cut from 2 mm. or 3/32 in. b.m.s. sheet, and are held to the frames by a length of steel angle 6 mm. x 6 mm. or 1/4 in. x 1/4 in.

Don't be tempted to use brass here even though this may be more readily obtainable. Steel is much stronger and looks better on the outside of the locomotive. If angle of the required thickness cannot be obtained, it would not take very long to file or mill it down from something thicker, or even mill the angle from 1/4 in. square b.m.s. Only 13 mm. for each side is required. Builders should take care to cut the slots for the ends of the slide bars in the correct position. To ensure this, temporarily clamp the cylinder to the frame, attach the slide bars, one at a time, line them up parallel to the frame, and measure between slide bar and frame with a small pair of calipers, or with strips of steel used like feelers.

The motion plates are held to the frames by three 8 BA hex-head screws. To line them up and at the same time line the cylinders up with the driving axle, first make sure that the latter is in the correct running position, which can be obtained from the drawing. Turn one end of a length of 3/16 in. dia. silver steel to a sharp point, and centre and drill the other end of it a nice fit for the piston rod. Pull the piston rod out, with the cylinder lightly held in position in its slot in the frame, and push on the silver-steel "pointer", lining this up with the centre of the driving axle. If the slot in the frame does not allow the cylinder to take up its correct position, it can be quickly eased out with a file.

## "SOUTHERN BELLE" DRAWINGS

Now available: L.O. 948. Sheet 1: General arrangement and frames. Sheet 2: Buffer beams, driving wheels and axles, full details of cylinders, crossheads, slide bars, coupling and connecting rods.

Price 85p each.

## BOOK REVIEWS

### "Britain's Railways in the Seventies"

Published by Ian Allan Ltd., Terminal House, Shepperton. 80 pp. Price £2.

This is a collection of pictures from photographs taken all over the British railway system, from Penzance to the Scottish Highlands. While most of the trains depicted are diesel or electric, some of the many steam locomotives which have been preserved are also shown.

Freight traffic has not been neglected, nor has the new High Speed Train. R.M.E.

### "Steam Engines and Waterwheels". A pictorial study of some early mining machines

by Frank D. Woodall

Published by Moorland Publishing Co., The Market Place, Hartington, Buxton, Derbys. Price £3.50.

In recent years there have been several books published on the mines in Cornwall, the Pennines, Wales, etc.,

but these have dealt mainly with social and economic matters. In this new work, the author describes the equipment used.

Chapters include "Before the days of steam power"—dealing with man and horse-power and early waterwheels, "Primitive steam power"—Newcomen engines, "The Cornish engine", rotary engines, vertical winding engines and ventilating fan engines.

Nearly all the illustrations are from Mr. Woodall's own negatives and several of his historical engines are shown.

The book is well produced on fine quality paper and is moderately priced. R.M.E.

### "The Steam Scene". Volume I

by R. J. Blenkinsop

Published by Steam Engine Publications, 78 Southern Road, Radford Semele, Nr. Leamington Spa, CV31 1VA. 94 pp. Price £2.95 plus 25p p.kg.

This is a collection of black and white photographs of traction engines, steam rollers, showman's engines, ploughing engines and steam wagons taken mainly at rallies during the last few years.

The illustrations are all of very good quality. R.M.E.

# “SOUTHERN BELLE”

## A New Locomotive for Gauge “I”

L.B.S.C.R. 4-4-2 “Atlantic” of class H.2

Part V

by Martin Evans

From page 913

THE BOGIES fitted to the L.B.S.C.R. “Atlantics” were similar to those on the Great Northern engines, that is to say of the “swing-link” variety, but this design is not easy to copy in model form even in the larger gauges. As far as my Gauge “I” model was concerned, I quickly came to the conclusion that discretion was the better part of valour as far as swing-link bogies were concerned! I am not going to say that the job is impossible; an enthusiast who is good at “watch-making” could no doubt make a good job of it, but for the average builder, I think a nice simple plate framed bogie with single overhead springs should fill the bill.

The bogie frames are cut from  $\frac{3}{32}$  in. bright mild steel; the unusual thickness will give us much needed weight, and builders will probably have enough of this left over from the main frames. All the holes are drilled No. 50, for 10 BA bolts.

I expect “Locosteam” will be able to provide little castings for the horns, probably in a “stick” of eight, and these can be quickly machined by end-milling, or they can be filed in much less time than it takes to set them up in the lathe.  $\frac{3}{64}$  in. rivets, copper or brass, would make a neat job of fixing them to the frames.

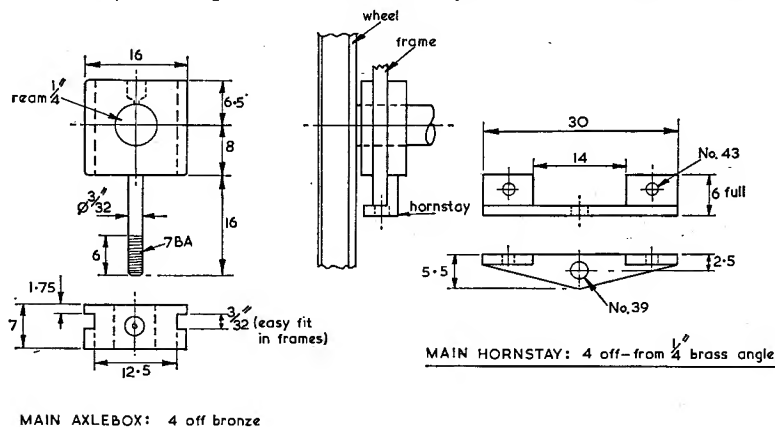
The bogie centre can be cut from the solid brass, as the section required is not particularly hefty—about  $\frac{5}{8}$  in. x  $\frac{3}{8}$  in. in Imperial dimensions. The top “flange” can be produced very quickly by milling away  $2\frac{1}{2}$  mm. from either end. The axleboxes could be made from brass bar, as here again the section required is quite small— $\frac{7}{16}$  in. square would do

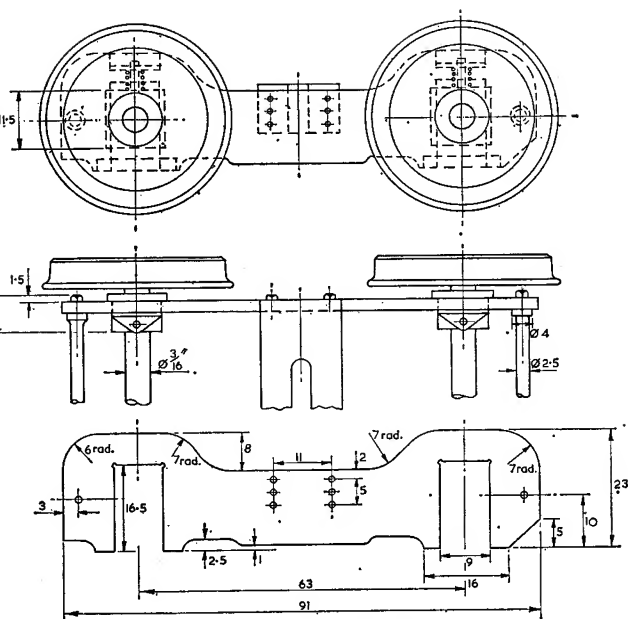
nicely; it is hardly worth going to gunmetal castings as wear here will be very slight.

At the time of writing, I am not certain whether “Locosteam” propose to supply castings for the trailing springs, but these too could be built up without too much difficulty, cutting them from  $\frac{1}{32}$  in. thick tufnol strip, seven leaves being required to give the required thickness. As a spring made in this way will be too stiff for a Gauge “I” locomotive, the solution will be to drill a hole vertically upwards into the bank of tufnol leaves and a similar hole vertically downwards into the axlebox, about 4 mm. deep, and fit a small compression spring. I should think one about 26 s.w.g. would be strong enough, as there will be a little flexibility in the tufnol of course. My drawing shows the correct details of the spring hangers, but whether builders will go to the trouble of reproducing these to scale is another matter!

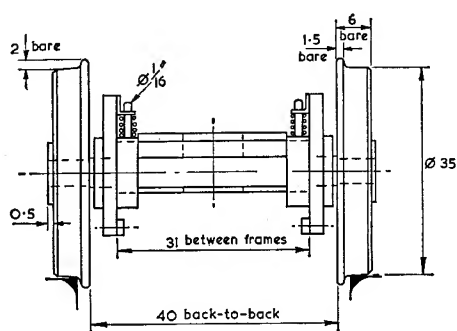
The trailing wheels are identical to the bogie wheels, while the trailing axle is a straightforward turning job from  $\frac{1}{4}$  in. dia. ground mild steel. The ends should be slightly rounded and polished, as should the axlebox journals. The bogie pin stretcher could be made from steel or brass, and the nearest section of material would be 1 in. x  $\frac{3}{16}$  in., as I don’t suppose anyone will have either metal in 5 mm. thickness.

It is held to the main frames by four 8 BA hex. head screws, which should be the type with 10 BA sized heads for neatness. In fact if any builder has not yet drilled the holes for this, I think they could

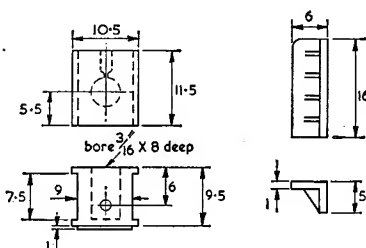




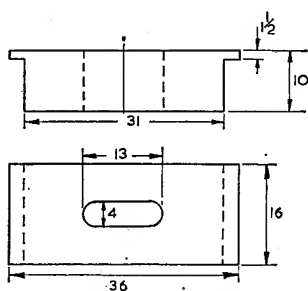
BOGIE FRAMES  $\frac{3}{32}$  b.m.s. all holes No.50



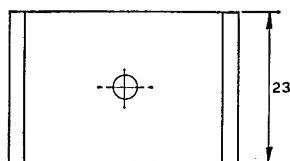
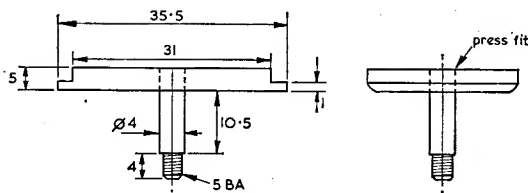
DETAILS OF THE BOGIE



ESSENTIAL DIMENSIONS OF TRAILING AXLEBOX & HORNS



BOGIE CENTRE: 1 off brass



BOGIE PIN STRETCHER: 1 off b.m.s. or brass

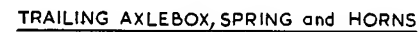
be cut down to No. 50, and 10 BA screws used, which will be plenty strong enough.

### Main axleboxes and hornstays

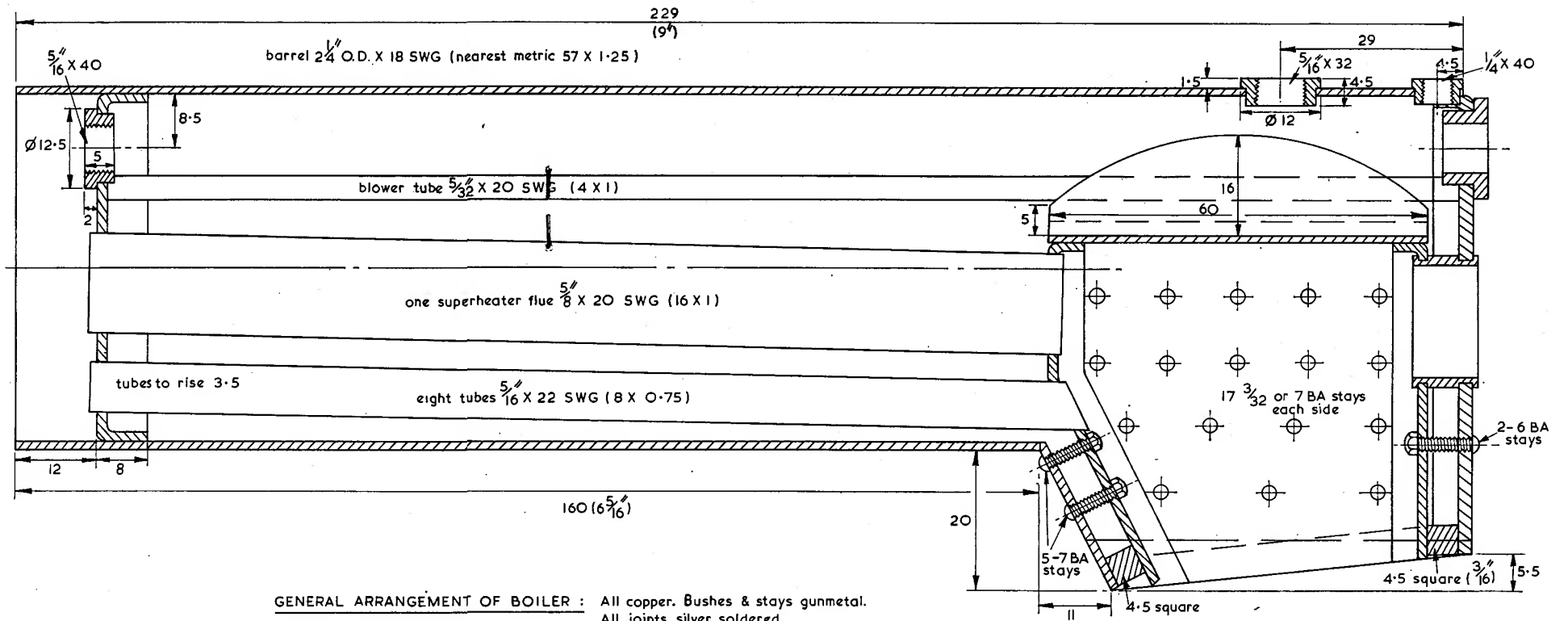
More than one reader has written to say that I appear to have forgotten to mention the main axleboxes and hornstays, so here are the details of these two items. The axleboxes can be made from flat gunmetal bar  $\frac{3}{8}$  in. x  $\frac{5}{16}$  in., the slot being milled, using either a  $\frac{3}{32}$  in. end mill (very fragile go carefully!) or a slitting saw of this thickness, the bar being held in a small machine vice bolted to the vertical slide. The hornstays (as there are actually no horns on this engine, perhaps they should just be called stays!) can be quickly made from  $\frac{1}{4}$  in. brass angle; they are fitted on the back of the frames underneath the axleboxes, as seen in my sketch.

### The boiler

Builders of my Gauge "I" *Green Arrow* tell me that the boiler designed for coal firing proved equally sound for bottled gas firing (using butane), the only alterations necessary being to provide a small inspection door and of course the blanking off of the grate area. I think the boiler for the Brighton "Atlantic" should prove equally versatile.

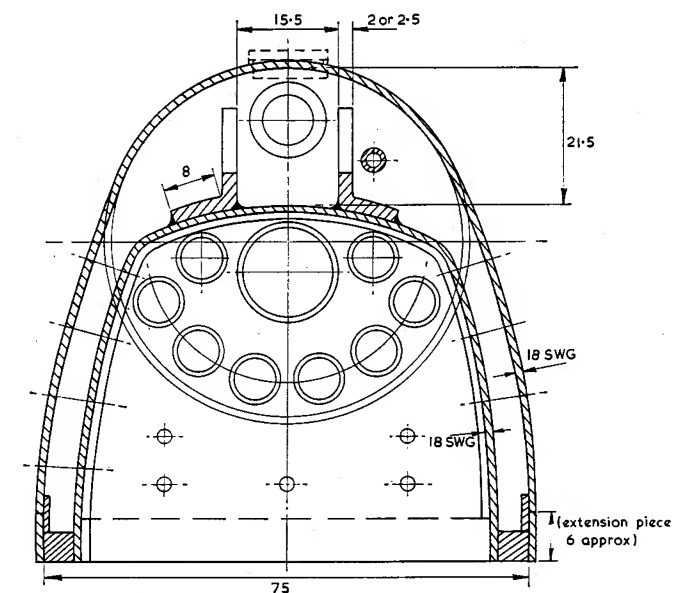
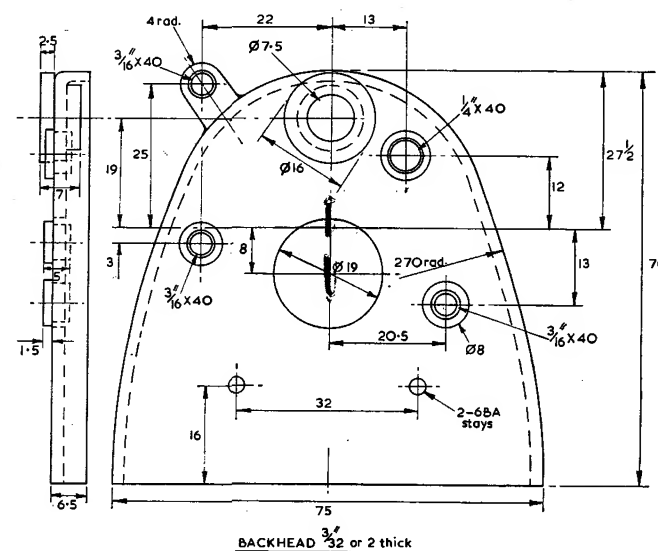


The basis of this boiler is a length of seamless copper tube 2½ in. outside diameter x 18 s.w.g. (I was compelled to return to Imperial dimensions here, as at the present moment, there does not appear to be any close metric equivalent on the market.) This is cut and opened out to form the outer firebox wrapper, though it is most unfortunate that this method does not give us a firebox that is quite deep enough, so that small extension pieces will have to be silver-soldered on. However, this is not a difficult job in this scale.



GENERAL ARRANGEMENT OF BOILER : All copper. Bushes & stays gunmetal.  
All joints silver soldered.

Working pressure 90 p.s.i.  
Hydraulic test pressure 180 p.s.i.  
Steam test pressure 100 p.s.i.

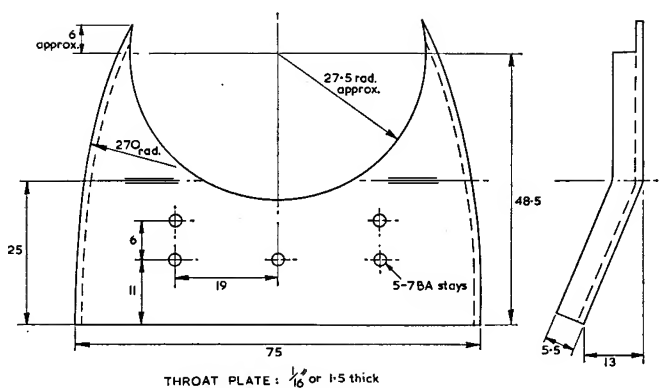


The throatplate is made from 1/16 in. copper sheet (or 1.5 mm.) and in this thickness, flanging should be quite an easy job. The formers can be made "sandwich" fashion, using 1/16 in. or 3/32 in. steel with a hardwood backing—oak or beech are best. This will save having to saw them out from 3/16 in. steel. Of the other flanged plates, the smokebox tubeplate, the firebox tubeplate, and the firebox backplate are all flanged from 1/16 in. (1.5 mm.) sheet, while the backhead is made from 3/32 in. or 2 mm. copper.

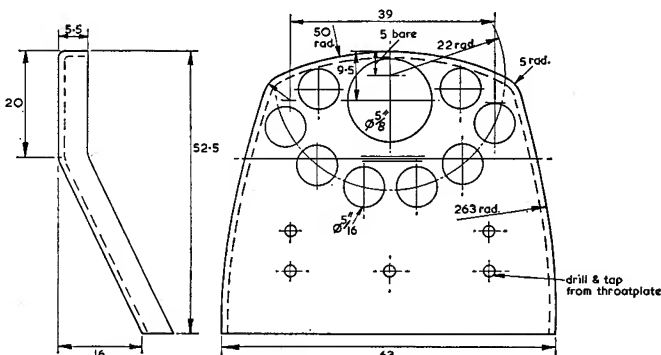
Construction can follow the usual order—after fitting the throatplate in place and silver-soldering the joints, the firebox plates are flanged and the firebox inner wrapper bent up from 18 s.w.g. copper sheet. It is of such a simple shape that proper bending rolls are hardly necessary, and copper sheet of this thickness, after annealing, bends very easily indeed.

Although the firebox backplate is a very simple affair, the firebox tubeplate has the additional complication of quite a sharp bend in the region of the tubes. But this should not cause us any real difficulty. The way to tackle it is to do all the bending first, then mark out and centre drill for the top three tubes only, that is for the central superheater flue and the two 5/16 in. tubes, which are in the area of the plate which is "square" to the tube bank. Centre these holes deeply and drill say 1/4 in. dia. to start with. Now obtain a piece of hardwood and shape it so as to fit inside the flange of the plate, its base being parallel with the "square" part of the plate. It will have to be at least 3/4 in. thick. The plate is now screwed to the wood block, using woodscrews through the three holes drilled. The centres of the other six holes should now be scribed, holding the plate and wood block up against something square and solid on the surface plate (or its equivalent).

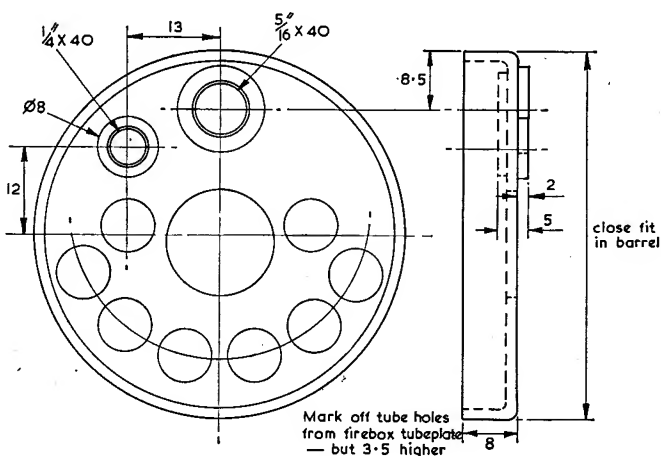
The plate, still attached to the wood block, can now be set up in the lathe, and the centres of the other holes brought to lathe centre, in turn, when the holes can be started with a medium sized centre drill, opened out with a larger centre drill until a small boring tool can be got through, when the holes are bored out to a few thou. under finished size. It will be appreciated that the plate is set up in the lathe with its upper part square to the lathe. This means that the lower, sloping part will be at a considerable angle to the lathe axis, which prevents us using a drill, which would quickly wander out of its true position; but by using centre drills only, which are far stiffer than ordinary drills, and following up with a boring tool, a true hole will result. Incidentally, don't ream any of these tube holes, but leave them a couple of thou. undersize, and skim the ends of the tubes down until they can just be twisted into their holes by hand pressure.



THROAT PLATE: 1/16 or 1.5 thick



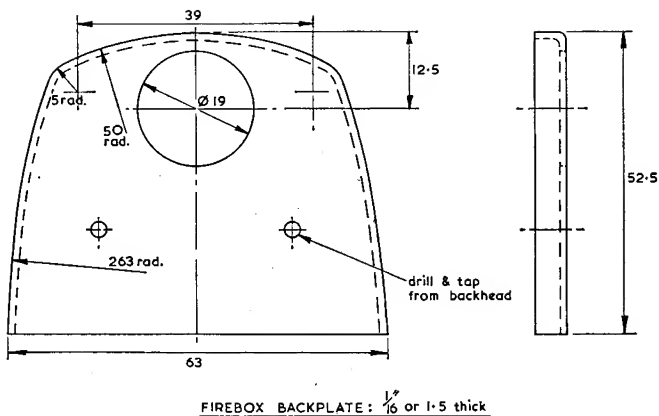
FIREBOX TUBEPLATE: 1/16 or 1.5 thick



SMOKEBOX TUBEPLATE: 1/16 or 1.5 thick

The slight shoulder so-formed will prevent the tubes sliding through into the firebox area under the heat of the silver-soldering operation.

The usual thick-walled copper tube is used for the fire-hole, and this can be brazed to the firebox backplate before assembly. Assembly of the firebox



can be done with just enough copper rivets or (home-made) gunmetal screws to hold the parts for silver-soldering. As the strength of the job depends entirely on the silver-soldering, the screws can be as small as 10 BA.

The firebox crown stays are my favourite type for "round-top" boilers, and in this case they are simplicity itself, just two lengths of 3/32 in. or 2 or 2.5 mm. copper sheet shaped and bent as shown and held temporarily to the crown by a couple of

gunmetal screws each, while they are silver-soldered.

To silver-solder the tubes, I find Easyflo as good as anything, and this can be obtained in wire form about 1/32 in. dia., which can be wrapped around each tube hard against the tubeplate. Provided that the plate and tubes are really clean, and that a few little nicks are filed in the tube holes to ensure that the solder flows right through, sound joints should follow from one heating.

Square copper bar, 3/16 in., is used for the foundation ring, and drawn gunmetal for the bushes and stays, which are 7 BA in the firebox sides in the throatplate, but 6 BA in the backhead. The holes for all these stays are drilled and tapped right through both plates, and ordinary commercial brass nuts can be used on the inside. After the bushes have all been fitted, the stays can be run over with Easyflo, or with one of the high-melting point soft solders, as preferred.

A hydraulic test at 180 p.s.i. should be carried out, for which purpose all the bushes will of course have to be blanked off, except the safety valve or manifold bush, to which the "test" pressure gauge can be attached, and one of the backhead bushes, to which the usual hand pump can be fitted.

*To be continued*

## A RATCHET-LESS LUBRICATOR

by D. C. Piddington

HERE IS, I hope, a new approach to the perennial problem of getting oil into the cylinders of our model steam locomotives. The traditional method in full size of driving the pump arm or crankshaft with an oscillating lever on to a pawl and ratchet mechanism does not lend itself too well to miniaturisation, though over the years many models have functioned perfectly using the standard LBSC type oscillating pump. The ratchet drive is, however, a fiddly assembly to make up even if one purchases a ready cut ratchet wheel. There are the pawls, springs, spring hanger pins to be considered, and one can find that the arrangement needs to be altered, the adjustment using one tooth per stroke not providing sufficient lubrication and two teeth too much. The latter either shows as a liberally bespattered driver, or hot oil running down the chimney and paintwork, or even both. Also some designs use the drive from the valve spindle as in LBSC's *Pansy* and when notching up the reverser, the pawl travel shortens and unless a very fine tooth ratchet wheel is fitted, no oil will be pumped into the system.

There have been other ratchetless drives, particularly by our friends in South Africa, and I think LBSC once suggested something similar. Recently I obtained from A. J. Reeves & Co. Ltd. two small objects which looked exactly like the familiar Torrington needle roller bearings. In fact these objects proved to be made by the same company but are described as "Roller Freewheel One-way Clutches", and are the smallest available nominally for 3 mm. shafts, but as they are made by an American firm, are actually in Imperial size for 1/8 in. shaft.

The maker's specifications for these quotes— "This miniature roller freewheel clutch must surely have the smallest cross-section of any roller freewheel now in production. Its relatively high torque capacity of 5.8 cm. kg. is achieved by distribution of the loads over a full complement of needle rollers. Wedges formed in the bore of the drawn cup outer race ensure that each needle roller will freewheel in one direction of rotation of the shaft and lock in the opposite direction. Mounting is extremely simple by pressing into a bored housing, and a hardened shaft is used as the inner member. Actual dimensions are 1/8 in. bore x 9/32 in. OD x 1/4 in. wide."

One of these clutches pressed into a suitable housing provided the key to the idea of driving a lubricator pump of the oscillating type for a 3 1/2 in. gauge locomotive. I needed a new pump anyway

# "SOUTHERN BELLE"

## A New Locomotive for Gauge "I"

L.B.S.C.R. 4-4-2 "Atlantic" of class H.2

Part VI

by Martin Evans

From page 1029

THE SMOKEBOX is the next item to be tackled. It is made from brass tube 2 5/16 in. o.d. This diameter was at one time stocked by the big non-ferrous metal stockholders in 20 s.w.g., 18 and 16 s.w.g. I am not sure of the present supply position, with the advent of metric sizes it is difficult to be precise as to availability, but I would advise builders to look for something about 18 s.w.g. if possible, as anything thinner than this is a bit delicate for a smokebox. On the exact thickness of the smokebox tube will depend the size of the joint ring between smokebox and barrel, but in any case, this ring could be made in the usual way—by bending up some flat strip brass about 5/16 in. x 1/4 in. section, silver soldering the joint and then turning to fit.

It might be a good plan to make this joint ring a permanent fit inside the smokebox and a nice push fit inside the end of the barrel, to which it can be held by about four 8 BA countersunk screws—the heads of these will be covered by the cleading sheet.

The front ring for the smokebox can be made in the same way, brass about 1/4 in. square being suitable, this being turned to angle section at the same setting as it is turned a tight fit in the front of the smokebox. Possibly one of our advertisers such as "Locosteam" will be supplying a casting for this, also for the smokebox door, although the latter can be made very quickly from a brass blank—one about 2 1/4 in. x 1/8 in. would do nicely.

My drawing gives the essential dimensions of the chimney and petticoat pipe; the latter could be made from copper tube, which is easier to anneal than brass, for "belling out" the bottom end. The petticoat is fixed by the usual lugs silver soldered to the tube and held by a couple of countersunk screws, the heads of which will be covered by the chimney.

As we cannot assemble the superheater until the regulator has been made and erected in the boiler, this could be tackled next. The body of this is made from gunmetal rod 7.5 mm. dia., or 5/16 in. skimmed down to size. Brass could be used at a pinch. To avoid waste of metal, the flange at the backhead end could be turned up from a separate piece of metal, in which case 3/8 in. dia. will just do. The joint should be made before any machining is carried out, of course, and it must be silver soldered.

One way of tackling the machining is to cut the bar about 1/4 in. over length, and machine the backhead end down to 1/4 in. dia. for a length of about 7/16 in. and just start the thread. The job can now be chucked by this end, the outer end being supported by the tailstock. A very light cut can now be taken along the whole length up to the flange, reducing it to 7.5 mm. dia. At the same setting, drill as far as possible with No. 30 drill, supporting the job with a steady. Open out with No. 28 drill and tap 3/16 in. Whitworth for a depth of 1 1/4 in. Now reverse, when the regulator body can be chucked close up to the flange, when the threaded end can be finished off and the body drilled and reamed 1/4 in. dia. to meet the first hole.

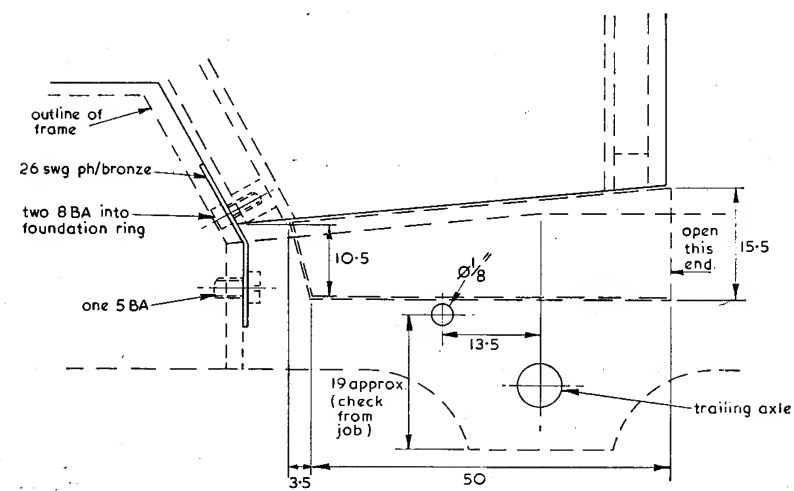
Of course with a standard length No. 28 drill, it will not be possible to go as far in as shown on my drawing; but this will not matter as long as the regulator spindle—1/8 in. dia. stainless steel rod—is quite free to turn in the body.

After drilling the steam entry holes, the tap can be put through again to clear the burrs. The spindle is made in two parts, the long part being made a tight fit into the front part, which is turned and threaded from 3/16 in. dia. stainless steel. A small pin can be put through the rear end of the threaded part, and the die run over this afterwards. The front part of the regulator body is a straightforward turning job.

3/16 in. dia. brass tube is used for the main steam pipe; this is threaded 40 t. at both ends and is then screwed home into the regulator after this has been completed and inserted from the backhead end. Plumbers' jointing on the threads will ensure a steam-tight joint, as long as the threads are a good fit. The main steam pipe is then locked in position with the usual nipple having 5/16 in. x 40 t. external and 3/16 in. x 40 t. internal threads, this being turned and filed to an oval shape from 1/4 in. dia. gunmetal bar. The header is made oval (18 mm. x 12.5 mm.) to match and is held to the nipple by two 6 BA stainless steel screws.

The superheater is made from 3/16 in. dia. stainless steel tube, but if anyone has difficulty in obtaining this, ordinary mild steel tube would have a reasonable life, before rusting sets in.

To make construction fairly easy, an ordinary brass tee piece is used for the exhaust, the blast pipe being bent as shown from 1/4 in. brass. Thick



Technical drawing of a regulator assembly, showing a cross-section and a side view.

**Cross-section details:**

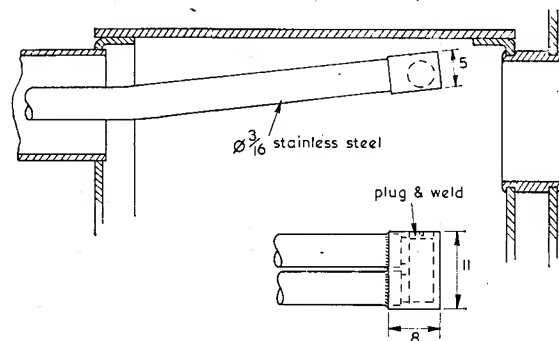
- Overall length: 116
- Outer diameter:  $\varnothing 16$
- Internal features:  $\varnothing 2$ ,  $\varnothing 2.75$ ,  $3/16$  whit, drill No. 28,  $\varnothing 1/8$ ,  $3/32$  sq., IOBA
- Dimensions: 9, 6, 6, 16, 8, 9, 3, 5, 2, 3
- Labels: No. 43,  $3/16 \times 40T$

**Side view details:**

- Dimensions: 20 No. 66, 4-No. 60 (balance holes),  $\varnothing 7.5$ ,  $1/4 \times 40T$

**REGULATOR: body gunmetal: spindle stainless steel (X 2)**

SUPERHEATER DETAILS (X2)



Technical drawing of a mechanical assembly, likely a fuel or gas valve, showing a top view and a side view.

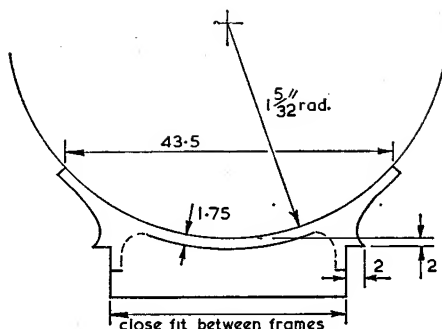
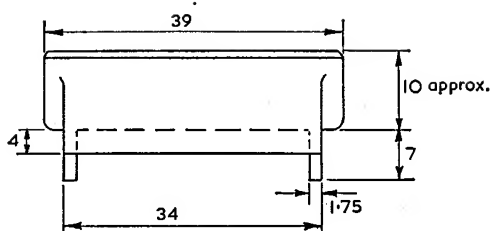
**Top View Dimensions and Labels:**

- 18 (Overall width)
- 12 (Overall height)
- 6 BA stainless steel (Material of the top cover)
- 3/32 x 28 swg (Wire size of the top cover)
- 3/16 (Diameter of the central opening)
- 1/32 (Orifice size)

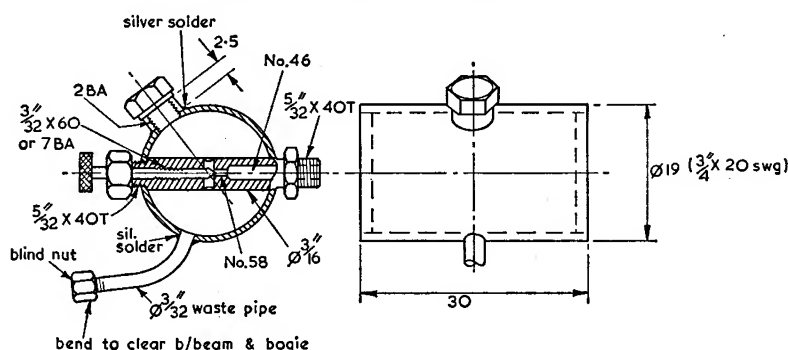
**Side View Dimensions and Labels:**

- 5/32 x 40T (Thread size of the central shaft)
- 3/16 (Diameter of the central shaft)

1211



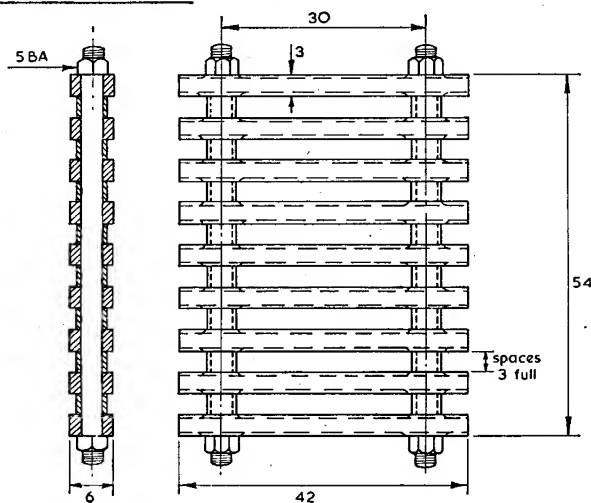
SADDLE: brass or gunmetal (X 2)



DISPLACEMENT LUBRICATOR (X 2)

walled tube could be used here, or as it is only a very short piece, it can be made from solid rod, but in either case it is worth annealing before bending. Copper tube can of course be used if preferred, though this does not take to threading quite so well. The blower tube is from 3/32 in. tube, thin-walled, and this is furnished with the usual union nut to make the connection on the smokebox tubeplate, and at the business end is fitted with a screwed cap drilled 1/32 in., which I think will pass enough steam without being too much of a drain on the boiler. A simple strip of brass will suffice to hold the blower in position, and the exact angle of the blower orifice is best set with the engine under steam; it is not quite so critical as the blast pipe itself, which must of course be carefully aligned with the petticoat pipe.

Builders may have some difficulty over assembling the steam tee and cross pipes into the steam chests as space is severely limited here. One of the cylinders will have to be taken off the frames, so perhaps it will be sensible to erect the steam pipes *before* the exhaust pipes. The steam tee can be sawn and filed from a piece of 1/4 in. square brass, and the vertical pipe which takes steam from the superheater can be screwed in tightly, with jointing on the threads, so that it can be assembled after the tee is in position with the pipes screwed into



GRATE stainless steel (X 2)

the steam chests. The steam pipes should be made with threads a shade on the tight side, so that with the application of plumbers' or similar jointing, they will stay steam tight without the usual locking nuts, for which there is no room this time. One of the pipes should have a thin hexagon nut soldered to it, approximately in the middle, so that it may

be turned with a thin spanner, or the whole pipe may be turned from hexagon bar. This pipe is used on the side from which one of the cylinders is temporarily removed, the other pipe being first screwed into its respective steam chest, followed by the "tee", the second pipe being then screwed into the tee as far as it will go. The other cylinder is then put back into place and the second pipe screwed back half way, into the steam chest of this cylinder.

A very simple displacement lubricator should take care of cylinder lubrication, this being an adaptation of that described by the late LBSC for his gauge "I" *Dot*. Its container is a length of 19 mm. ( $\frac{3}{4}$  in.) brass tube about 20 s.w.g. A boss is silver soldered onto this to provide sufficient depth of thread for a filler cap with 2 BA threads, and a drainpipe is silver soldered in near the bottom, this being brought out to clear the front buffer beam and bogie. The "works" of the lubricator are turned from  $\frac{3}{16}$  in. dia. gunmetal, and the "body" of this is assembled from the cylinder end. If it is turned to make a tight push fit at *both* ends, ordinary soft solder could be used, but if there is any doubt about this, then it would have to be hard solder, as the tank is of course under pressure only a little under boiler pressure.

#### Saddle

I expect that our advertisers will be able to supply a little gunmetal casting for the saddle, and in this size it would not be difficult to machine the curved top surface on which the boiler rests, using a fly-cutter with the tip of the cutter set to describe

a diameter of  $2\frac{5}{16}$  in. The other surfaces can be finished by filing, noting that the sides fit between the frames, the smokebox being held down securely by seven 10 BA bolts each side.

When the saddle has been completed, the smokebox and boiler unit can be bolted to it, the correct height being that the underside of the smokebox is 2 mm. above the top edge of the frames at this point. The boiler is then set horizontal and is held down at the rear by a strip of 26 s.w.g. phosphor-bronze screwed to the front section of the foundation ring by two 8 BA screws (stainless for preference) and to the cross-stretcher which connects the main to the trailing frames by one 5 BA bolt, as shown. This method of holding down the boiler, though quite unorthodox, has the advantage that the sides and rear of the firebox are left quite clear, making it easier to fit the grate and ashpan.

The ashpan is quite a simple affair, bent up from steel (stainless for preference) about 26 s.w.g. The grate rests on top of this, and the whole is held tight against the underside of the firebox by the  $\frac{1}{8}$  in. dia. retaining pin, inserted from one side.

One final point. Builders who have erected their frames and buffer beams have pointed out that if the front buffer beams are left rectangular in side elevation (as shown in the drawing) the lower rear corners do not follow the outline of the frames, and come very close to the front bogie wheels. I had assumed that builders would file the corners of these beams to follow the outline of the frames, but to avoid confusion, I will alter the drawings to make this point clear.

*To be continued*

## Dial Gauge Lathe Stop

by Dr. A. R. Bracey

A PROBLEM when boring in the lathe, especially to a predetermined depth and using the self-act, is to know when to disengage. On the ML7 I had solved the problem by fixing a dial indicator gauge to the bed of the lathe below the headstock with the plunger pointing tailwards and attaching a tube to the saddle using the screws holding the felt retaining pad. A rod of suitable length was inserted in this tube and the saddle moved to the required depth and the rod adjusted to press on the plunger to move the pointer a few divisions and the dial zero ring rotated to match the pointer. In self-act all one had to do was to watch the pointer and disengage the self-act lever one or two thou. before zero. This method was also used when screw-cutting and turning to an external shoulder. The gauge and the tube are permanent fixtures of the lathe.

This ML7 served me well for many years and I

then became more ambitious and acquired an ML Super 7 with gearbox—and discovered that there was no space to fit a standard dial indicator gauge. Since the original had proved so useful I decided to make one to fit in the available space.

The whole measures  $2\frac{1}{2}$  in. x 2 in. x 1 in. with a dovetail slot at the rear to slide on a plate screwed to the lathe bed. The dial rotates and can be set to a zero mark. The plunger is pressed on by a rod (of variable length) attached to the leadscrew guard.

The body consists of two end pieces of 1 in. x  $\frac{3}{16}$  in. brass 2 in. long. The rear piece has a dovetail slot milled out with the aid of a standard end-mill and a specially made one to cut the 45 deg. angle. The top and bottom plates are of  $\frac{1}{16}$  in. brass attached to the ends with 8 BA csk. screws. The top plate has a stepped bush with a  $\frac{3}{32}$  in. hole (for the gear spindle). The bottom plate has two  $\frac{3}{32}$  in. holes for gear spindles. These holes have  $\frac{1}{8}$  in. x  $\frac{1}{16}$  in. discs soldered on their underneath surfaces to retain the spindles.

The rotating dial holder was made from two

# "SOUTHERN BELLE"

## A New Locomotive for Gauge "I"

L.B.S.C.R. 4-4-2 "Atlantic" of class H.2

Part VII

by Martin Evans

From page 1213

3 December 1976

IT IS NOW TIME to deal with the remaining boiler fittings. The regulator has already been described, and here is the drawing of its handle—a double-ended one similar to that used on the G.N.R. "Atlantics". It can be made quickly by turning down a length of stainless or mild steel, or nickel-silver strip, the nearest available to 3.5 x 2 mm. (The nearest commercial strip will probably be 3/16 in. x 3/32 in.)

The 4-jaw chuck can be used, the outer end being supported by the tailstock, and high speed and very lights cuts are indicated, as the material is so slim. After turning, the ends are bent as shown, and it may be advisable to do the bending hot. The square hole is drilled and filed out with a fine needle file to complete.

Hexagon gunmetal is used for the safety valve, 12 mm. or 7/16 in. A/F being about right. The body is a very simple turning job, and while the ball seating may be finished with a 7/32 in. "D" bit, a home-made cutter, to undercut the seating, makes a better job, more likely to shut down properly. The ball might well be a bronze one, as some of the so-called rustless steel balls about today do not seem to live up to their name. The spring could be rustless steel or phosphor-bronze.

### Water Gauge

It is always a bit of a problem making a water gauge small enough for a Gauge "I" locomotive, while at the same time getting the glass large enough in diameter to give a reasonably true reading. However, I think that shown in my drawing represents a reasonable compromise. I am not sure at the time of writing whether any of our advertisers can supply little gunmetal castings for the top and bottom fittings, but if not, they can be made by silver-soldering short lengths of round drawn or cast gunmetal, 7 mm. or 9/32 in. dia., the gland nuts being made from 8 mm. or 5/16 in. A/F hexagon bar.

In this small size, the blow-down valve spindle is best made from the solid, 6 mm. or 1/4 in. dia. stainless steel being used, with the hand-wheel knurled and fitted with a little pin about 1 mm. dia.

### Manifold

The manifold and whistle valve can start life as

a 21 mm. length of 7 mm. or 9/32 in. square material. As the three threaded union connections have to be fitted at an angle, in order to clear the cab roof, the sides of this bar are best filed off at the required angle, where the unions are fitted, leaving the whistle valve end the full square section. Some careful drilling will be required, the body of the fitting being drilled right through No. 48 following up with No. 30 drill from each end, and forming a seating for the 3/32 in. dia. ball. Both ends are then tapped 5/32 in. x 40 t. The pin to operate the whistle valve can be 1 1/4 mm. dia. and turned down to 1 mm. where it passes through the No. 48 hole. The union connections are threaded 3/16 in. x 40 t. for the blower and pressure gauge, and 5/32 in. x 40 for the whistle.

At the smokebox end, a simple fitting is required, threaded externally 1/4 in. x 40 t. and internally 5/32 in. x 40, for the hollow blower stay, and on the other end of this fitting, a union connection with 3/16 in. x 40 thread for the blower pipe, which will be 3/32 in. dia.

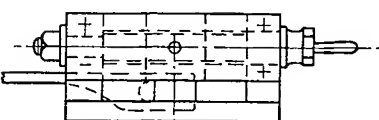
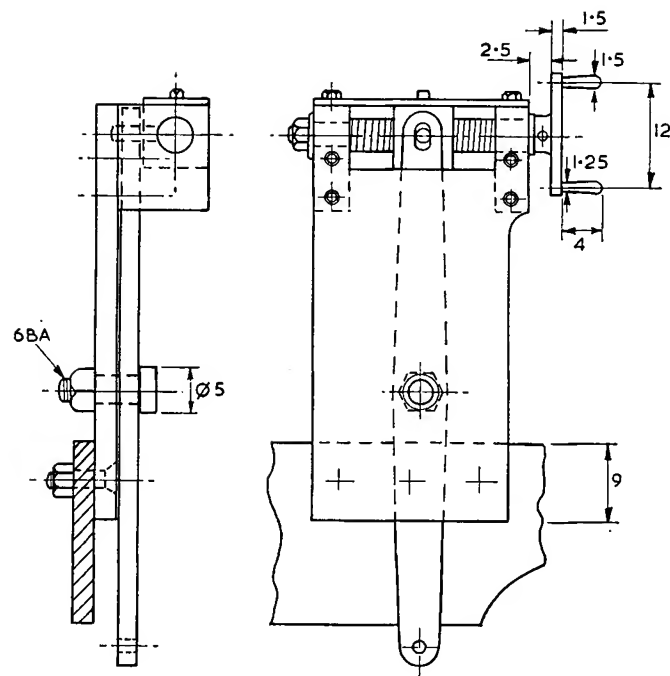
The blower valve is quite straightforward; its jet might be about No. 56 for coal firing, or No. 60 for butane firing, the latter not requiring such a fierce draught. The check valve too is conventional, using a bronze or stainless steel ball 5/32 in. dia. on a reamed seating 1/8 in. dia. Ball lift can be a bare 1 mm.

### Cab Reverser

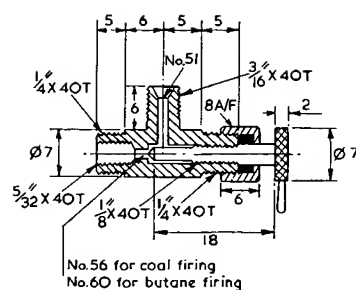
Back now to the chassis, to complete the valve gear. We left this at the long rocker, which transmits the movement from the reach rod (which passes underneath the trailing axle) to the intermediate reach rod, which itself connects to the reversing arm (page 910, 17 September 1976).

The reach rod could be made from 4 mm. or 5/32 in. square mild steel, or 5/32 in. x 1/16 in. strip could be used, with a little block brazed on from which to form the fork at the rear end. This rod has a substantial "set" in it, to bring the fork into line with the cab reverser, which is bolted to the left-hand trailing frame, as shown.

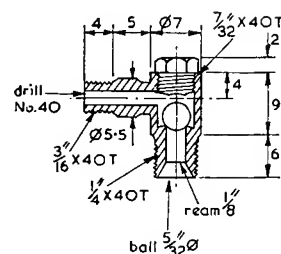
The cab reverser is of rather unusual design. Its basis is a piece of 2 mm. flat steel plate (3/32 in.) to which the two gunmetal bearings are bolted, using 10 BA bolts. The front bearing is reamed



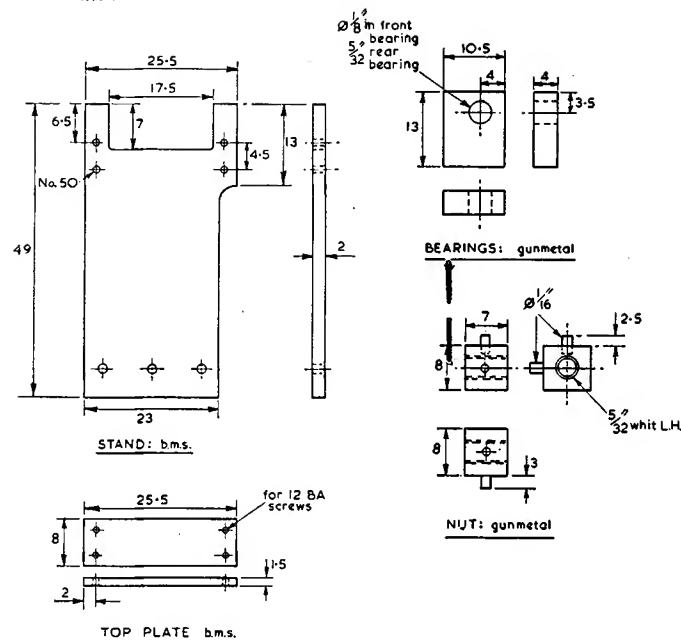
CAB REVERSING GEAR



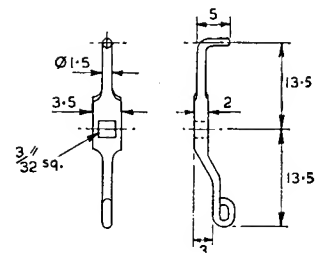
BLOWER VALVE: body gunmetal, spindle rustless steel (X2)



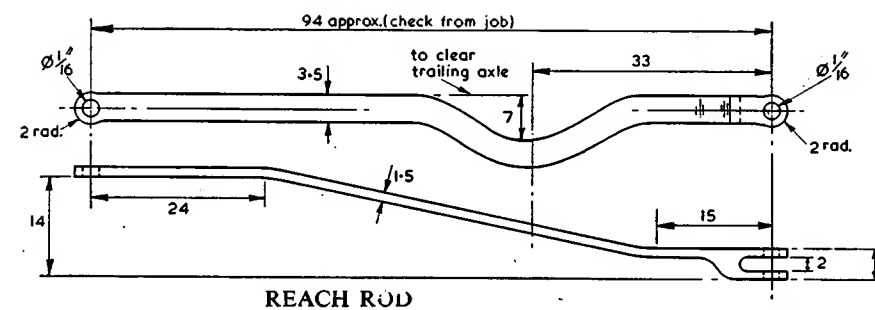
CHECK VALVE: gunmetal



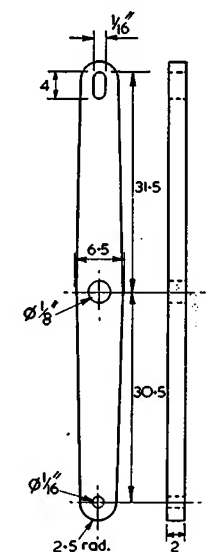
TOP PLATE b.m.s.



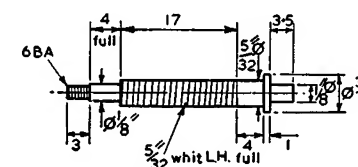
REGULATOR HANDLE: rustless steel (X2)



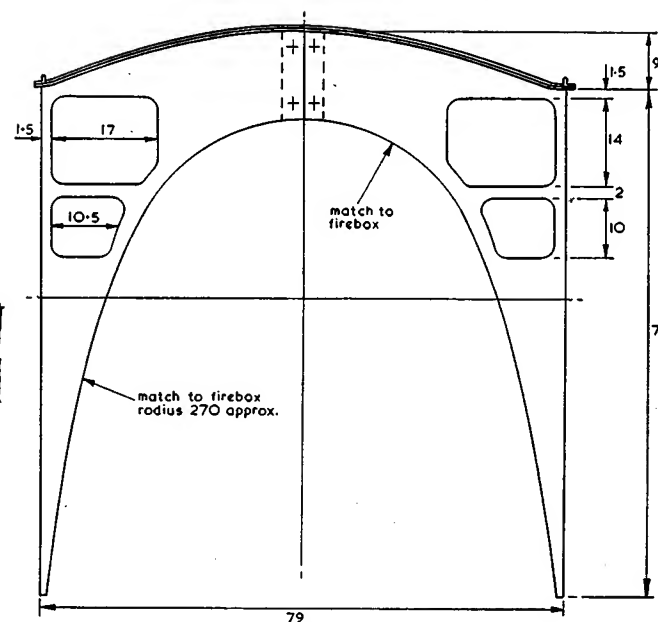
REACH ROD



ROCKER: b.m.s.



SCREW: b.m.s.



SPECTACLE PLATE: brass or nickel silver 22 SWG.

1/4 in. dia., and the rear bearing 5/32 in. dia. The screw is turned from 3/16 in. dia. b.m.s. and is threaded 5/32 in. left-hand Whit., the front journal being turned down to 1/4 in. dia., and again to take a 6 BA thread at the extreme end. The nut measures 8 x 8 x 7 mm., and carries a plain pin 1/16 in. dia. to engage in the slot at the top of the lever, or rocker, which is cut from 2 mm. (3/32 in.) b.m.s.

The stand is bolted to the trailing frame by three 8 BA bolts, with the lever (rocker) between it and

## Platework

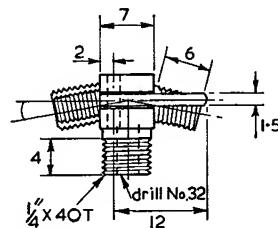
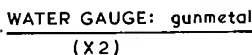
piece of the material to be used, to avoid having to scrap the full-length piece.

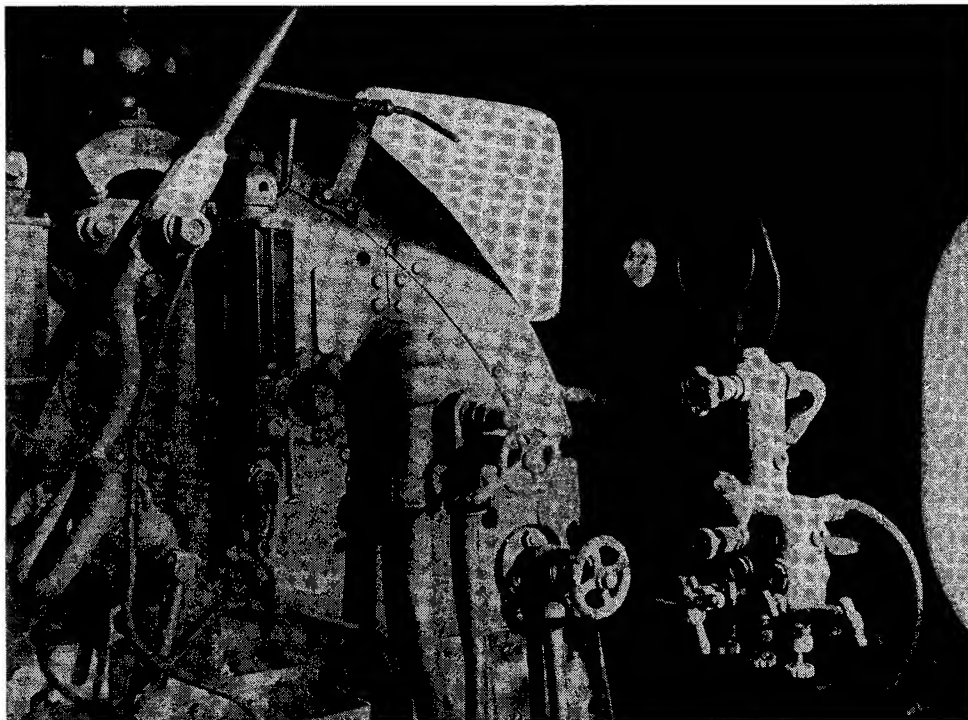
A slot will be required in the left-hand running board, to clear the cab reverser; to stiffen the gap, a further piece of sheet brass can be fitted on the top, held by four 12 BA screws and nuts, as shown. The running boards need some support in the middle, and this can be provided by a bracket made from brass angle. There is just room for this between the driving and coupled wheels, and it is held to the frame by a single 6 BA screw. The ends of the running boards are held down on the buffer and drag beams with 10 BA hex. head screws.

Technical drawings of the Safety Valve assembly. The top drawing is a side view showing a vertical assembly with a top cap (Ø 9.5), a central valve stem (Ø 1.5), and a base. Dimensions include a total height of 13, a base height of 4.5, and a central section height of 3. The valve stem has a 1/4 x 40T thread at the top and a 5/16 x 32 T thread at the bottom. The base has a 12A/F or 7/16 thread. A 5/32 ball is shown in the center. The bottom drawing is a top view of the base, showing a hexagonal shape with 8 holes No. 5B. The side view also shows a 1/4 x 40T thread on the left side and a 5/32 x 40T thread on the right side. A 1/8 ream is indicated at the bottom of the central section.

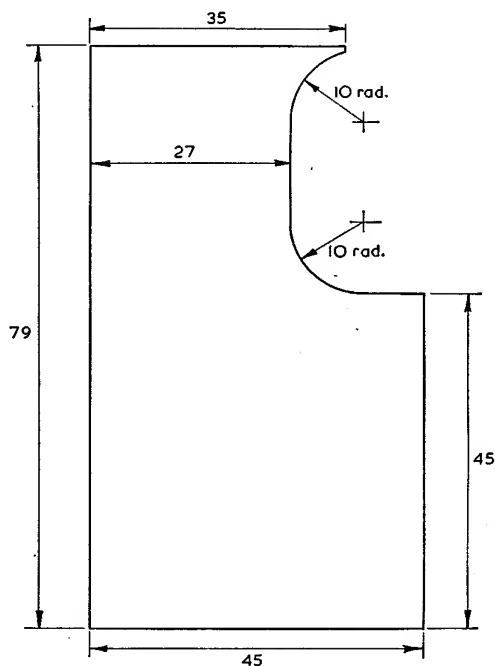
SMOKEBOX UNION FOR BLOWER: gunmetal  
(X 2)

SAFETY VALVE: gunmetal  
(X2)





*Cab fittings of a L.B.S.C.R. "Atlantic". Photograph by Ron Isted.*



CAB SIDE: 22 or 24 SWG brass or nickel-silver

splashers are best made individually, but the tops of both can be made in one piece, with cutaways to clear the boiler barrel. They can be permanently soft-soldered to the running boards.

The cab sides should be very easy to make, using brass or nickel-silver, 22 or 24 SWG; they are held to the running boards by 3/16 in. brass angles, plus further angles to attach them to the spectacle plate—which is unusual in having two “spectacles” on each side of the firebox. Incidentally, the spectacle plate has to be made in two pieces, with the join on the centre-line of the engine, above the firebox, otherwise it would be impossible to get it into position owing to the top fitting of the water gauge being in the way. The cab roof will require a fair sized hinged or sliding section, to give good access to the controls, but it can still be held firmly by short pieces of angle attached to the cab sides, and a further section of angle bent to follow the contour of the top edge of the spectacle plate.

The beading on the cab sides can be represented by half-round brass wire about 3/64 in. or 18 SWG soft-soldered in place. It is not a bad plan to make up two or three little clamps, similar to toolmakers' clamps, but of aluminium, to hold the beading to the plate while soldering.

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*The drawing of the running boards of “Southern Belle” will be published in the next issue.*

# “SOUTHERN BELLE”

## A New Locomotive for Gauge “I”

L.B.S.C.R. 4-4-2 “Atlantic” of class H.2

Part VIII

by Martin Evans

From page 153

IT IS NOW TIME to make a start on the tender. My side elevation drawing is based on the outline drawing by the late J. N. Maskelyne, so it should be fairly close to scale. It is quite a simple tender to make, even the raised top coping being straightforward with no difficult bending involved.

I have shown fully detailed springs, horns and axleboxes, the former being actual leaf springs, which can be built up from strips of tufnol about 1/32 in. thick, or they can be solid, with hidden coil springs about 3/32 in. dia.

The tender frames are cut from 1/16 in. or 1.5 mm. bright mild steel. Only six holes are required, unless it is desired to fit brake gear, in which case, three additional holes will be required to take the hanger pins.

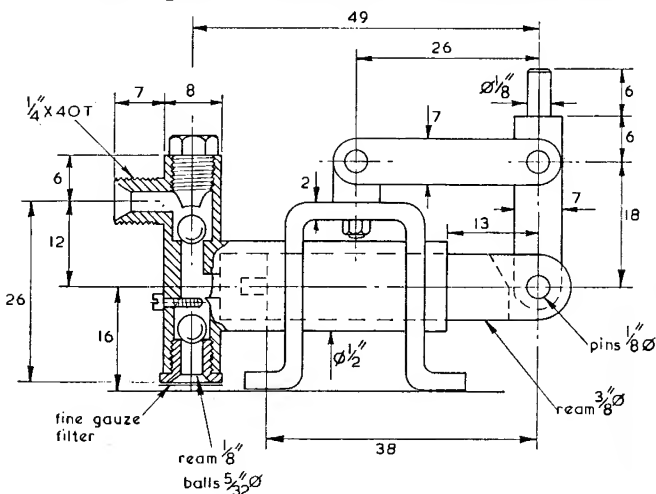
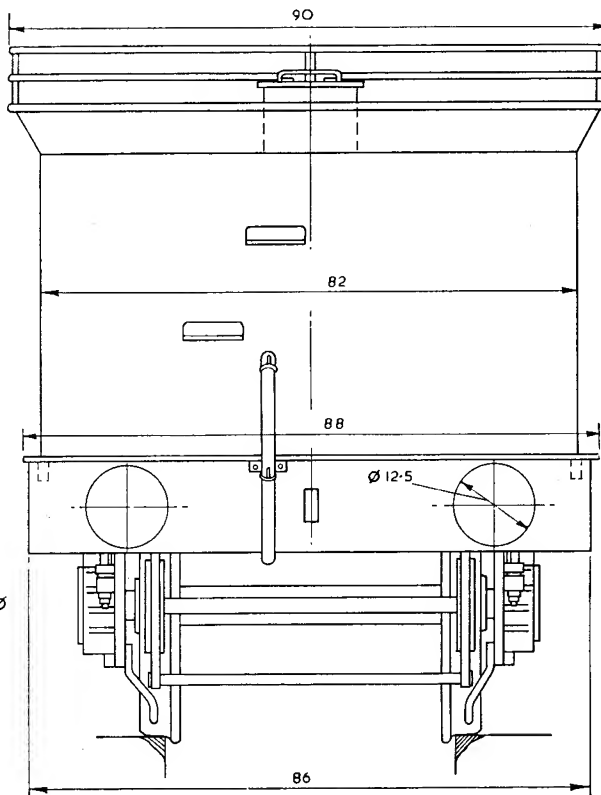
The buffer beams can be cut from brass bar, 14 mm. x 10 mm. or the nearest available section, and the frames are held to them at each end by 8 BA hexagon-head screws into tapped holes in the beams. Then two simple round stretchers are needed. These could be 3/16 in. dia. b.m.s., also tapped 8 BA.

For the tender floor, we can use 20 s.w.g. hard brass. Try to get some nice flat stuff for this, as it is difficult to straighten. The tender body is then built up on this, using 3/16 in. brass angle between

sides and floor and between ends and floor. The same angle can be used to support the top “deck”, but this should be left removable, so as to give access to the hand pump and piping. The present drawing shows “internals” suitable for the coal-fired version; I will deal with butane firing later. But in either case, the inside of the tender body must of course be made water-tight, either by sweating over all angles etc. with soft solder, or by the use of the new adhesives, such as Araldite or Loctite. The complete tender body can be held down to the frames by four screws, put through the floor into tapped holes in the thicker part of the buffer and drag beams.

No special comment should be needed on the

REAR VIEW OF TENDER



TENDER HAND PUMP (x2)



this too passes through the floor via a double flange, ending up just underneath the water filler.

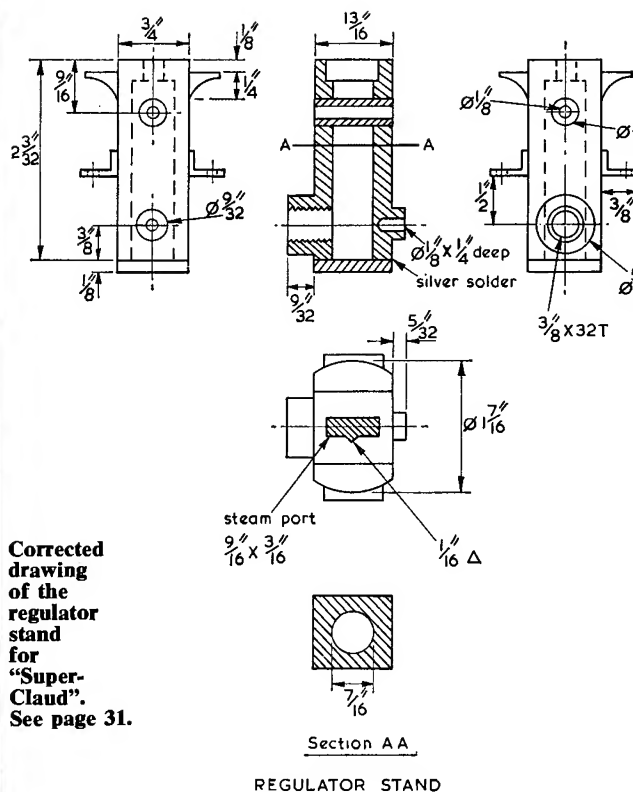
There is not a great deal of detail work on this tender. The coal rails could be made from half-round brass wire about 18 s.w.g., with the vertical supports about 1/16 in. square. The joints could be soft soldered, but a much better job will be made if silver solder is used here. It will pay for the builder to make up three or four miniature tool-maker's clamps to hold things together while silver soldering. Make them from aluminium alloy or dural, then the solder won't "take" to them.

The same half-round wire can be used for the beading around the top edge of the tender, but here soft solder will hold all right, owing to the much greater area of contact.

A small problem may arise over the fitting of the tender buffers, as the centres of these unfortunately coincide with the ends of the frames. But the stocks can be turned to say 5/32 in. dia. for a length of not more than 2 mm. for a push fit into holes drilled in the buffer beam, and four small screws used to hold the stocks to the beams. These will have to be no larger than 12 BA if appearance is not to be spoilt.

The springs can then be accommodated inside the body of the buffer heads.

*To be continued*



# MODEL ENGINEER EXHIBITION

## Further reports from Wembley

### The Locomotives

by Peter Dupen

LAST YEAR'S EXHIBITION was an outstanding one as far as the Locomotive Section was concerned, with 23 entries, and as I mentioned in my report, it was a pity we did not have half a dozen Championship Cups to award, such was the high standard of entries.

This year, in spite of a new exhibition hall at Wembley with all the services and amenities one could wish for, the Locomotive Section was rather disappointing, only 12 entries and the quality not up to the high standard we have come to expect.

Of course there were some very fine models on show this year, and the builders have every right to be proud of them, but for a Championship Cup you require that little extra, and that I regret was missing this year, in fact we were unable to award a Championship Cup for the section this year. I

am sure this is only a temporary relapse, there are many fine locomotives being built and these will be exhibited at future exhibitions, and remember it is not only award-winning models that make an exhibition, all model locomotives make an interesting and attractive display.

And now to the model locomotives at the Exhibition: first, a very fine 3½ in. gauge 2-10-0 B.R. Class 9 92000 by Mr. R. W. Gale of Newport, Gwent, an impressive locomotive and very difficult to model in 3½ in. gauge, but a study of the detail work put in by Mr. Gale was most rewarding, the safety valves correct in every detail, as were the boiler turret and top feed clacks with flanged pipe connections, crossheads fitted to piston rods with cotters, not taper pins, the workmanship in the motion was excellent with no oversize rods or pins, in fact the model followed very closely the prototype, even the cab layout, which is almost impossible to scale in this gauge, did not distract from the general appearance.